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ABSTRACT

These materials have been developed by Project CREATE (Cooperative Resources to Enhance Access to Jobs through Technical Education), a demonstration program designed to develop a network, specific activities, and resources that would provide education and support services to a wide audience. A 13-page final report describes the hands-on training in metalworking, automotive repair, printing and graphics, and computerized numerical control (CNC); resource, curriculum, and staff development; skills assessment survey; and conference activities. These training materials were provided in the document: training course outlines for automotive, machining, and printing/graphic arts; evaluation forms and data tables; and automotive pretests, posttests, chapter tests, and answer keys in English and Spanish. These resources follow: Coordinated Training Agreements in metalworking and printing; skills survey for printing, automotive, and machining trades in English/Spanish; and copies of the newsletter, ACCESS. The next section contains the report of the conference, "Opening Doors in the Nineties: Workers, Skills, and Diversity," which brought together over 125 representatives from education, employment and training, government, community-based organizations, labor, and industry. Included in the document is an independent evaluation that sees the value of the project as a model for a community-based institution that coordinates and provides leadership in the area of vocational training. A curriculum for CNC repair is also provided. (YLB)

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PROJECT CREATE FINAL REPORT

COOPERATIVE RESOURCES TO ENHANCE ACCESS TO TECHNOLOGY EDUCATION

Machine Action Project
Hampden County Employment and Training Consortium
1176 Main Street
Springfield, Massachusetts 01103

Grant funded by:

United States Department of Education
Office of Adult and Vocational Education

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January 23,1991

Dear Reader,

Project CREATE - **Cooperative Resources to Enhance Access to jobs through Technology Education** - has completed a successful 18 month training and research effort funded through a $309,000 grant from the United States Department of Education's Office of Adult and Vocational Education. This report, plus the enclosed documents and video summarize the results of CREATE's major activities. CREATE was organized by the Springfield, Massachusetts based Machine Action Project. The grant was supported by a match of well over $100,000 in services and in-kind contributions from the private sector and area training facilities.

Community and private sector cooperation resulted in Coordinated Training Agreements in the machining and printing trades. A "career ladder" approach to training was established by combining the best training services each individual institution has to offer into one delivery system. Copies of these training agreements are attached.

CREATE had an equity component which worked with government, community-based organizations, vocational schools, training institutions and employers to disseminate information about the training programs among women, people of color, and linguistic minorities. It also helped training providers and vocational schools develop recruitment and retention strategies which would allow the targetted populations successful access to training and jobs.

In addition CREATE brought over 125 representatives from education, employment and training, government, community-based organizations, labor, and industry together on May 22, 1990 in a conference, **Opening Doors In The Nineties: Workers, Skills and Diversity**. The conference was divided into four parts: 1) a video, produced by CREATE staff, depicted workforce and educational issues which limit the access that women, people of color and linguistic minorities have to well-paying career fields; 2) a panel, "Creating Blueprints for the Workforce of the Nineties" presented concrete examples of strategies and programs that 'open doors'; 3) a workshop, "The 'Ism's' and the 'Wasm's'" dealt with issues of oppression - mainly racism and sexism; and 4) several workgroups were formed so that participants could begin to formulate initiatives that would not only **Open the Doors,** but ***Keep them Open.*** A copy of the conference final report is included.

A skills assessment survey of 209 workers in the metalworking, automotive technologies, and graphics and printing fields was completed and published. The survey was unique in that it was designed to interview workers and *ask them* how they see technology impacting on their jobs. A copy of the survey questionnaire and final report are included.

It is our hope that these materials will help others in the employment and training field meet the critical skills development and educational needs of an increasingly diverse workforce. If you have any questions or would like additional copies of the materials please write to:

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CREATE FINAL REPORT

INTRODUCTION TO THE REPORT

Project CREATE - **Cooperative Resources to Enhance Access to jobs through Technical Education** - has completed a successful 18 month training and research effort funded through a $309,000 grant from the United States Department of Education's Office of Adult and Vocational Education. This report, plus the enclosed documents and video summarize the results of CREATE's major activities. It is our hope that these materials will help others in the employment and training field meet the critical skills development and educational needs of an increasingly diverse workforce.

CREATE was organized by the Springfield, Massachusetts based Machine Action Project. The grant was supported by a match of well over $100,000 in services and in-kind contributions from the private sector and area training facilities. Hands-on training in metalworking, automotive repair, and printing and graphics was given to 167 Western Massachusetts residents.

GRANT HIGHLIGHTS:

1. TRAINING

A. Final training results (original grant goals in parenthesis).

1. 8 training programs (4 proposed).
2. 167 students trained (70 proposed).
3. 1133 training hours (741 proposed).
4. 76% completion rate for the 8 courses.

B. Results of surveys taken after completion of training.

1. 91.8% were interested in attending future CREATE classes.
2. 90.6% found their training course to be either good or excellent.
3. 80.4% agreed or strongly agreed that the training provided them with skills they could immediately use on their jobs.
4. 67.5% agreed that their employer gave them work reflecting their new skills.

2. RESOURCE, CURRICULUM, AND STAFF DEVELOPMENT

Pre and post tests were developed in each training field to help grant staff and instructors determine course effectiveness. Course evaluations were done by each student to help us improve the training. Sample copies of these evaluation forms are included in this report.

CREATE's automotive and CNC Repair curriculum were newly developed and state-of-the-art. The automotive courses were a collaboration between individuals from local repair shops and dealerships, General Motors Corp. (GM), Sun Electric Corp., the Massachusetts Division of Apprentice Training, and Project CREATE. Manuals and text books were donated by GM. High-tech training equipment was loaned by the Sun Electric Corp. and late model automobiles to be used for hands-on training were loaned by local car dealers. Training was conducted at the William J. Dean Technical High School in Holyoke.

Curriculum for the CNC Maintenance & Repair course was developed by the heads of the electronics, electrical and mechanical departments of the Technologies Division of Springfield Technical Comunity College (STCC), vocational high school teachers, Smith and Wesson, Inc., D&S Manufacturing, Bridgeport Machine Corp., Cincinnati Milicron, and LeBlond Corp. This collaboration resulted in a course that met industry's needs, and a curriculum that is one of the most comprehensive available. A copy of the course outline is provided in this report.

Key community and private sector cooperation resulted in Coordinated Training Agreements in the machining and printing trades. A "career ladder" approach to training was established by combining the best training services each individual institution has to offer into one coordinated delivery system. Copies of these training agreements are attached.

Six area vocational high school instructors received technical skills upgrading by attending offered courses. This allowed them to stay abreast of changing technology, and pass along knowledge to their students. Without such instructor upgrading this information would have been unavailable to the students.

Project CREATE had an equity component which worked with government, community-based organizations, vocational schools, training institutions and employers to disseminate information about the training programs among women, people of color, and linguistic minorities who were unemployed or underskilled. It also helped training providers and vocational schools develop recruitment and retention strategies which would allow the targetted populations successful access to training and jobs.

3. RESEARCH

A skills assessment survey of 209 workers in the metalworking, automotive technologies, and graphics and printing fields was completed and published. The survey was unique in that it was designed to interview workers and ***ask them*** how they see technology impacting on their jobs. A copy of the survey questionnaire and final report are included.

4. CONFERENCE ACTIVITIES

Project CREATE brought over 125 representatives from education, employment and training, government, community-based organizations, labor, and industry together on May 22, 1990 in a conference, **Opening Doors In The Nineties: Workers, Skills and Diversity**. The conference was divided into four parts: 1) a video, produced by CREATE staff, depicted workforce and educational issues which limit the access that women, people of color and linguistic minorities have to well-paying career fields; 2) a panel, "Creating Blueprints for the Workforce of the Nineties" presented concrete examples of strategies and programs that 'open doors'; 3) a workshop, "The 'Ism's' and the 'Wasm's'" dealt with issues of oppression - mainly racism and sexism; and 4) several workgroups were formed so that participants could begin to formulate initiatives that would not only **Open the Doors,** but ***Keep them Open.*** A copy of the conference final report is included.

What follows is a more detailed summary of the grant activities. If you have any questions about the Project or would like additional copies of the materials please call or write to:

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I. TRAINING SUMMARY

From April 10, 1989 to December 31, 1990, Project CREATE organized a Cooperative Demonstration Project involving several Hampden and Hampshire County, Massachusetts employers, secondary and post-secondary schools, public sector training providers, federal and state agencies, and community organizations in the development of several training programs. Courses were the result of labor market research conducted by Project CREATE during the summer of 1989. Three training fields were selected: high-tech automotive repair; graphic arts/printing technology; and basic machining and Computer Numerical Control machine maintenance & repair. Through this collaboration 167 trainees benefitted from eight skills training and upgrading programs. Several lessons were learned about how to recruit and retain students in skills training programs and extensive research was done to determine the training needs of local industries.

A. TRAINING TOTALS

Due to excellent cooperation with industry and support from training institutions such as Dean Technical High School, Putnam Vocational-Technical High School in Springfield, and STCC, CREATE was able to offer more training than the grant had originally called for. This led to significantly higher enrollment numbers than were proposed.

FINAL RESULTS (original grant goals in parenthesis)

8 training programs (4 proposed)

167 students trained (70 proposed)

1133 training hours (741 proposed)

76% completion rate

B. OBSERVATIONS AND LESSONS LEARNED

1. RECRUITMENT

Training courses were offered at Dean Technical High School, Putnam Vocational/ Technical High School and STCC. Intensive efforts were made to recruit women, people of color and limited English proficient persons into entry level and skills upgrading courses. It soon became apparent that CREATE needed to clearly define its recruitment guidelines concerning these sectors of the population. The following procedures were developed by the grant's Race & Sex Equity Specialist (RSE) for this purpose.

RECRUITMENT GUIDELINES

1. Write a short description of course and minimum requirements needed to enter training, e.g., work experience, math skills, language skills.

2. Develop screening tools such as applications, test, and interview questionnaires.

3. Set realistic recruitment goals that reflect the proportionate representation of target populations where training will be offered.

4. Develop a recruitment strategy that will provide access to women, people of

color and linguistic minorities. This strategy must include outreach to agencies and organizations that provide services to these populations.

5. Arrange meetings with outside agencies and people co-participating in recruitment with the Training Coordinator and RSE Specialist to discuss steps 1 through 4 before recruitment begins.

6. Begin recruitment 3 months before a training program starts to allow time for outreach.

7. Offer tests, interviews, and assess the support needs of applicants no later than 1 month before a program starts.

8. Coordinate the support services needed to ensure retention of trainees in the program, including a Bilingual Instructor's Aide, tutoring, and math help where needed.

9. Establish a panel with a minimum of 3 persons, including the Instructor, Training Coordinator, and RSE Specialist, to select the trainees.

10. Give the trainees information on the program, including the names and telephone numbers of the Training Coordinator and RSE Specialist during the first class. Both will be present to reiterate their availability as support staff.

Recruiting our intended population proved to be difficult. Rather than simply running advertisements in the newspaper, it was necessary to approach prospective students - women, people of color and linguistic minorities - on a much more personal basis. Contact was made several times to demonstrate our real interest in their being successful in the training program. Once we were able to convince people of our sincerity in helping them enhance their skills and employability, the word spread about the opportunities available, and there was abundant interest from would-be students.

Recruitment of women into the automotive courses was difficult because there were very few experienced women technicians in the field. Because of the advanced nature of training, it was determined by the instructor that a minimum of two years experience was necessary for enrollment. Women mechanics and technicians are still discriminated against, and there is little encouragement for them to enter the trade. At the time of our initial recruitment we had not tapped into the female mechanic/technician network, which we felt was small and disjointed, but must exist. We learned from the few women technicians we were able to locate that they preferred to receive their training through the workplace. They were paid to train during the day at manufacturer-sponsored schools and were able to keep their nights free. This kept our enrollment of women to a minimum.

Recruitment of African Americans into the training programs offered at Dean Technical in Holyoke was low. One key reason was location. While Holyoke's population is approximately 35% Hispanic, the African American population is less than 1%. Springfield has an African American population of 16.5%. Individuals recruited from Springfield would have to commute to Holyoke, something that Springfield residents have historically failed to do. Despite personal approaches to prospective students CREATE experienced a low African American enrollment at Dean Technical.

Significant recruitment in the automotive field was done by the regional field representative from the Mass. Division of Apprentice Training. This collaboration proved to be extremely productive as he was able to gain program support from a number of repair shops while assisting in the recruitment process.

The most important lesson we learned was that contact on a personal basis was essential in recruiting for our programs. CREATE approached community-based organizations (CBOs) which had already developed trust and formed working relationships with their clientele. CREATE also contacted by mail, telephone, or in person, local, state and federal agencies such as the Division of Employment Training, the Massachusetts Division of Apprentice Training and the United States Department of Labor. In addition, the best recruiters of all were students who have completed training. Individuals who have been treated with respect, supported through training, and gained valuable knowledge and skills were excellent role models for others in the community.

2. INTERNAL SUPPORT

Our first class, Automotive Electricity and Electronics, was designed to upgrade the skills of those with two or more years of experience in the trade. Twenty-two students were recruited: 13 white males; 7 Hispanic males; 1 white female; and 1 African American male. The percentage of Hispanics (32%) adequately represented the demographic make-up of the Holyoke (site of training) population.

Five of the 7 Hispanics who enrolled dropped out of the course. Although the reasons given for dropping out appeared valid, the Create staff was disturbed by the fact that all dropouts were linguistic minorities. The Race/Sex Equity Specialist and Training Coordinator interviewed each of them at their workplaces and decided that if there had been a support system in place, 3 or 4 trainees might have been able to overcome their difficulties and finish the course.

As a result, a support system was developed for two subsequent automotive classes. One hour prior to the first class the seven linguistic minority students attended a meeting conducted in Spanish. Students were provided with information about course goals, resources and format. This session also provided an opportunity to: let students know the staff was concerned with their success; allow students an opportunity to become acquainted with each other; have them exchange telephone numbers should they need a ride or moral support; give the more proficient English speakers a chance to volunteer to help those with limited English ability; and remind them to contact members of the CREATE staff should they need any assistance. Periodic student follow-up and regular contact with the instructor were also a part of the support system. With the support system in place, nobody dropped out of the new courses. Much of this success was due to the ability of the Race/Sex Equity Specialist to speak with the students in their language, and demonstrate her, and the program's, genuine concern for the students.

Support also came from taking attendance. Initially attendance was simply a record keeping function. CREATE had the instructor's take attendance and forward it bi-monthly to the training coordinator. This method resulted in delayed responses in addressing the needs of students having difficulty with the class material. Due to the sophistication of training it was imperative to maintain more consistent contact with the trainees and be available to tutor or assist them. It was determined that the attendance sheet would be delivered to the Training Coordinator at the end of each week's classes. All students who missed two days of class were contacted to determine why, and offered any assistance that was available. With this personal follow-up the students knew they were being supported and CREATE staff were able to limit dropouts from the automotive program. These same procedures were used in the Graphic Arts/Printing and CNC Maintenance and Repair courses as well.

3. COMMUNITY AND PRIVATE SECTOR PARTICIPATION

Collaboration with local training institutions, the private sector, Federal and State government agencies, and local community organizations was critical to the development and success of the training programs. Curriculum development, training supplies, recruitment, and administrative functions are costs that should be shared by all parties benefitting from training.

The automotive and CNC Repair curriculum were developed specifically for Create programs. The Printing/Graphic Arts course used the existing Putnam Vocational Technical High School curriculum as it was the most advanced available in Hampden County. The automotive courses resulted from a collaboration between Dean Technical High School, local repair shops and dealerships, General Motors Corp., Sun Electric Corp., the Massachusetts Division of Apprentice Training, and Project CREATE. GM donated manuals and text books, while training equipment and late-model automobiles were loaned to the program by Sun Electric Corp. and local car dealerships. Curriculum for the CNC Maintenance & Repair course was developed by the heads of the electronics, electrical and mechanical departments of the Technologies Division of STCC, the Hampden County Vocational High School system, Smith and Wesson, D&S Manufacturing, Bridgeport Machine, Cincinnati Milicron, and a number of other machine tool builders. This collaboration insured the course would meet industry's needs.

Community and private sector cooperation resulted in Coordinated Training Agreements in the machining and printing trades. A "career ladder" approach to training was established by combining the best services each institution had to offer in one coordinated delivery system. Training at the vocational and technical high school level was linked with advanced and evening courses at local community colleges. Each student who finished an offered course received a Certificate of Completion which carried with it a specific number of college credits at STCC, and training-related classroom hours that counted toward journeyperson's papers from the Massachusetts Division of Apprentice Training.

Six area vocational high school instructors received technical skills upgrading by attending offered courses. This allowed them to stay abreast of changing technology, and pass along new knowledge to their students. Without such instructor upgrading this information would have been unavailable to these students.

Additional resources and services donated to the Dean Technical program include: 1) Dean Technical becoming only the third high school in the state of Massachusetts to become Automotive Service Excellence certified; 2) Dean Technical inspected by General Motors to possibly become an Automotive Service Educational Program site; 3) Ford donation to Dean Technical of an F-250 Big Foot truck; 4) Ford and Chrysler interest in underwriting additional training courses; 5) Camilleri Bros. Chevrolet dealership donation of a 1989 Celebrity station wagon; 6) Meg-Tech One electronic trouble-shooting computer system and related software donated by the evening automotive program students.

4. FUNDER - VENDER RELATIONSHIP

CREATE's first training program was done by a local machinist training provider that had instructed adults for many years. Because CREATE's start-up date coincided with the start-up of this machining course, time did not allow the Training Coordinator and the RSE specialist to fully develop support systems, recruitment and retention strategies, address any language or translation issues, discuss the curriculum, or provide a means for the Training Coordinator to have a role in program decision-making. The program started with 20 trainees, 8 finished, and only 5 took jobs in machining. From this experience CREATE learned that it had to be a full participant in all decisions affecting training it was sponsoring. The necessity for the Training Coordinator to be seen as someone with the authority to make recommendations regarding policy, recruitment, curriculum, and access/equity issues had to be established.

A second problem occurred when the Trainng Coordinator tried to convince a training provider to make some changes recommended by students. The changes were agreed to but never implemented. Three students dropped out as a result. This kind of intransigence - 'we've done it this way for years, why should we change? - we know what we're doing' needs to be met head-on if the needs and concerns of trainees are to be more consistently met.

II. TESTS AND EVALUATIONS

A. TESTING

Pre-tests were conducted for the Automotive and Computer Numerical Control (CNC) machine maintenance & repair classes. The tests were designed to identify applicants who were over or under-qualified for the course being offered. Those who were, were not accepted because it was determined that they would become bored or overwhelmed, lose interest and drop out, preventing others from having an opportunity to enroll. Testing for the Graphic Arts/Printing class was not necessary as it was designed for entry level students.

In the first course pre-testing was conducted at the automotive student's workplace due to the independence of the automotive business and the logistics involved. But it was decided to use a more controlled environment to ensure an accurate assessment and the second round of automotive pre-tests took place in a classroom. The tests were designed to quiz applicants on material to be covered in class. Machine maintenance and repair class applicants took tests in math and English reading and comprehension at STCC. Tests were intended to recruit a highly qualified class due to the technical nature of the training. During the first class a pre-test on subject matter was also given to determine machining knowledge.

The automotive and CNC maintenance & repair instructors designed weekly content tests to stimulate the growth of knowledge. The tests were open book and meant to prod the students to use their text books. Final tests for the automotive and CNC machine maintenance & repair classes were administered using the same pre-tests in order to determine if there were any improvements in knowledge and skills.

Analysis of Pre- and Post-Test Results

AUTO PHASE ONE: 1989 ***(sixteen tested/fourteen question test)***

13 students had scores improve an average 37%.

1 student dropped 12% (13 to 12 correct) and 1 dropped 33% (9 to 6 correct)

1 student's score didn't change.

AUTO PHASE ONE : 1990 ***(ten tested/fourteen question test)***

9 students had scores improve an average 33%.

1 student improved 112% from 4 correct to 8.5 correct answers.

1 student improved 100% from 5 correct to 10 correct answers.

1 student's score didn't change - 8 correct.

AUTO PHASE TWO : JAN -1990 ***(fifteen tested/eighteen question test)***

14 students had scores improve an average 39%.

1 student improved 433% from 3 correct to 16 correct.

AUTO PHASE TWO: OCT.-1990 ***(fifteen tested/eighteen question test)***

All 15 students had scores improve an average 32%.

1 student improved 450% from 4 correct to 18 correct.

CNC MAINTENANCE & REPAIR 1990 ***(fourteen tested/eight responses*)***

SUBJECT	START	FINISH	IMPROVEMENT
ELECTRICAL (class avg.)	49.0%	68.5%	19.5%
METAL MACHINING "	71.5%	82.0%	10.5%
CNC/ELECTRONICS "	51.0%	81.0%	30.0%

* Final tests were taken on last day of class with actual tests being mailed back. Only eight tests were received.

B. MIDPOINT AND FINAL EVALUATIONS

The research and planning that goes into the development of a training program does not guarantee that it will adequately address the needs of trainees. CREATE conducted interim and final evaluations to allow students to voice their concerns about each course. The interim evaluation consisted of 18 multiple choice and 1 essay questions. The multiple choice questions covered such things as content, hands-on instruction, course difficulty, individual instruction, and instructor techniques, while the essay question requested specific suggestions for improving the course. The final evaluation was more comprehensive, and included the interim questions and additional ones designed to determine the usability of the skills taught, the interest the trainee's supervisor showed in the student's progress, and specific positive and negative aspects of the course.

Interim evaluations were administered and analyzed during the fourth week of class. CREATE was able to determine whether the course was meeting the needs of the students. An effort was made to implement recommended changes whenever possible. Final evaluation forms were distributed on the last night of class, with the results used to improve future training.

Aggregate results of all final student evaluations:

1. 91.8% were interested in attending future CREATE classes.
2. 90.6% found their training course to be good or excellent.
3. 83.2% agreed or strongly agreed they learned a lot from taking training.
4. 80.4% either agreed or strongly agreed that the training provided them with skills they could use immediately on their jobs.
5. 67.5% agreed that their employer assigned them work duties that reflected their new job skills.

III. POST-TRAINING QUESTIONNAIRE

A. BACKGROUND

CREATE developed a questionnaire for trainees and supervisors to help determine if trainees were utilizing their newly acquired skills, received a salary increase, and were assigned new job responsibilities upon completion of training. It was administered to 2 supervisors from each trade, along with 7 printing/graphic artist, 6 machining, and 5 automotive trainees.

B. POST-TRAINING SURVEY HIGHLIGHTS*

1. Trainees

Question	YES		UNSURE		NO	
	n	%	n	%	n	%
Since completing training, have you had the opportunity to use your new skills?	15	83%	0	0%	3	16%
Has your employer assigned you duties that utilize your new skills?	10	55%	0	0%	8	45%
Did you receive a pay raise due to your new skills?	3	16%	1	6%	14	78%
Do you want to attend additional training courses?	16	89%	2	11%	0	0%
Has your employer supported your progress?	16	89%	0	0%	2	11%
Was it worthwhile participating in this program?	17	94%	0	0%	1	6%

2. Employers

Question	YES		UNSURE		NO	
	n	%	n	%	n	%
Do you feel the material taught was relevant to your business needs?	5	100%	0	0%	0	0%
Did the training provide your employee with skills that could be used immediately on the job?	5	83%	1	17%	0	0%
Did you provide your employee with new job responsibilities reflecting their increased skill and ability?	3	50%	1	17%	2	33%
Have you promoted or given your employee more authority as a result of these newly acquired skills?	0	0%	0	0%	6	100%

* n = number of respondents; % = percentage of total

C. DISCUSSION OF SURVEY RESULTS

1. Trainees

A majority (72%) of students entered training with clear-cut ideas about what they expected from the course. While almost all agreed that the training fulfilled their expectations, one automotive trainee felt the course failed him because it was too basic.

As a group, 15 out of 18 trainees (83%) stated that they were utilizing their new skills on the job. Broken down into separate industries, the results showed that while printing/graphic artist and automotive trainees (with 1 exception) agreed that they were using their new skills on the job, machining trainees were less likely to do so. All 5 automotive trainees reported using new computer diagnostic skills on equipment like the Monitor 2000, and in working on Distributorless Ignition Systems, and the analysis of electrical problems and relays. Six of seven printing/graphic artists trainees reported using a wide variety of new skills including camera usage, troubleshooting on plate and press related problems. Two machining trainees reported that they were not using any new skills, while those that did, used them sparingly, primarily repairing CNC's and manual machines. One general machinist who took the CNC repair course found a new job installing and maintaining new CNC machinery for a private vendor. He doubled his rate of pay from $9.00/hr. to $18.00/hr.

It is interesting to note that while 83% of the trainees reported using their new skills on the job, their supervisors reported that only 50% of trainees were formally assigned new job duties. Overall, 14 of 18 trainees did not receive a pay raise when they completed the course. When asked if their employer or supervisor had taken an interest in their training and supported their progress, one printing and one automotive trainee said no, while one machining trainee was unsure.

Retention of newly learned skills is vitally important and greatly depends upon whether the trainee uses his/her skills regularly. Almost 50% felt that they would lose their skills within 6 months, and 25% between 1 and 2 years if they were not reguarly utilized on the job. Automotive technicians, as a group, felt that they would lose their new skills more quickly than the other trades, with 60% indicating that they would lose them within 6 months without regular use.

All 18 students said they wanted and needed additional skills to progress in their trade. Everyone wanted more hands-on training. Machinists requested more training in Computer Numerical Control machining, metallurgy, electronics, and machine troubleshooting. Printing/ graphic artists wanted training in typesetting, use of camera color keys and chemicals, new ink formulations, sheet fed and web presses, computerized set-up and the use of half-tones. Automotive technicians cited a need for training in automotive computer systems, diagnostics, including wiring diagrams and circuits, Electronic Fuel Injection, Throttle Body Back-up, Electronic Control Modules, computer ride control, and anti-lock brakes.

English is a second language for several trainees, but as a group no one indicated that they had trouble with the technical language used during training, and 94% said they had no trouble keeping up with the class.

Students in each course had varied levels of experience in the trade. Classes were structured to allow more experienced trainees to work in small groups with those with less skill. When asked if this was an effective way to organize the classes, responses were favorable by a two to one margin with students with less experience stating that it was a real advantage to work with people who had several years in their trade.

2. Supervisors and Shop Owners

Trainees' foreman/supervisors were asked about the effectiveness of the training, whether or not they assigned employees work that incorporated their newly learned skills, and their willingness to collaborate in future training programs. Sixty-six percent of management took an interest in their employee's participation and progress during training. There was unanimous agreement that the material taught was relevant to their needs, with 83% indicating that the courses provided their employees with skills that could be used immediately.

All the supervisors and owners said they were willing to help in the development of curriculum and training programs for their industry. With one exception, there was agreement to provide monetary support to develop training programs and pay registration fees for employees participating in training. Sixty-six per cent agreed to give workers paid time off to attend the training.

Within each field, employers/supervisors were asked to identify the specific skills they felt were critical to worker success. The results for each trade are listed in the order of importance they indicated.

Machining: machine set-up; diagram, manual, chart and blueprint interpretation; quality control and inspection; problem-solving skills; Computer Assisted Drafting; machine repair; math; reading and writing; electronics; and computer literacy.

Automotive: reading and writing; computer literacy; problem-solving skills; electronics; interpreting diagrams, manuals, charts and blueprints; and math.

Printing/Graphic Arts: machine set-up; problem-solving skills; interpretation of diagrams, manuals, charts and blueprints; math; reading and writing; machine repair; computer literacy; and quality control and inspection.

The responses were almost evenly divided when employers were asked if they provided workers with responsibilities that reflected their new skills and abilities. Machining responses were unsure or negative. One supervisor anticipated assigning more responsibilities to an employee in the near future. The automotive responses were both affirmative, and the printing/ graphics responses were split. All the supervisors and owners agreed that their employees were better skilled, yet none had promoted or given them more formal authority at work. As for the actual hands-on utilization of new skills, three employers commented as follows: "I now have my employee working with outside repair people on CNC equipment" - machining; "It has enabled me to give more computer-related jobs to more employees" - automotive; "I am able to have my employee operate the camera equipment without supervision" - printing/graphic arts.

The responses indicated that new skills were being used, sometimes in a conscious and designed manner, but very often in an unplanned way. This issue needs more extensive study in the future. Training dollars will be used ineffectively unless firms and training providers develop conscious, detailed plans to integrate newly achieved skills into the workforce quickly and effectively.

IV. MAJOR FINDINGS AND RECOMMENDATIONS

There is no question that the training we provided was important to those who received it and the companies that need trained, skilled personnel. We also took a few small steps in the direction of understanding the access and equity issues that the employment and training system needs to address. The recommendations here are not meant to be exhaustive. They do represent some of the major lessons learned during the grant cycle.

1. Support structures are vital for student success. Individuals, regardless of race, sex, or language, entered training programs and completed them. The development of student support structures, including attendance follow-up, personal counseling, bilingual staff, shop visitors, job shadowing, and mentorships, was instrumental in this success.

2. Community-based organizations need to be involved in all aspects of training program development and recruitment. Establishing such relationships is time consuming but the long term results are worth the effort. Training institutions and community organizations and agencies are natural allies in any effort to provide high quality training to individuals who have been denied access to such programs.

3. Dynamic classroom structures that allow better skilled trainees to work in small groups with those who do not possess skills are effective. The same approach works well when there are limited English proficient students in a classroom. For example, a limited English speaking student may have more technical skills than others in the class. By pairing that student with others with stronger language skills each learns quickly from the other. Stereotypes that tie 'intelligence' to language proficiency begin to be broken down. Students, by acting as instructors with each other, are empowered . In the long run this enhances self-esteem and provides trainees with important interpersonal skills they can use on the job.

4. Many employers are not prepared, or possibly willing, to provide their workers with job assignments using newly learned skills or give them salary increases upon the completion of a training program. But they are ready and willing to support skills training for their employees and participate in new program and curriculum development efforts. Every effort should be made to involve employers in program development at the earliest possible stage. This will help insure that they are confident enough in a program to hire individuals from it, send their employees to it, and financially support it. During this collaboration steps should be taken to help employers develop strategies for successfully translate their workers new skills into job assignments. If this does not happen skills will be forgotten and the cost effectiveness of programs will suffer dramatically.

5. Programs should be constantly evaluated by all the participants. Feedback from students, teachers, and employers will strengthen any course being offered. At the same time an independent evaluation conducted during the program, not just at the end, can help to focus attention on plan weaknesses the organizers may not see. Corrective measures can then be applied before the program is over and falls short of its intended objectives.

V. DOCUMENTS INCLUDED IN THIS REPORT

1. TRAINING

A. Course Outlines.

B. Enrollment: Training hours & ethnicity totals.

C. Student Interim and Final Evaluation survey forms & tables.

D. Post-training survey forms for trainee & supervisor.

E. Automotive pre- and post-tests & answers in English and Spanish.

F. Phase 1 Electricity and Electronics Automotive weekly tests in Spanish & answers.

G. Phase 2 General Motors Automotive weekly tests & answers.

2. RESOURCE, CURRICULUM, AND STAFF DEVELOPMENT

A. Coordinated Training Agreements in Metalworking and Printing.

B. CNC Repair and Maintenance curriculum outline.

C. Skills survey for Printing, Automotive and Machining trades in English/Spanish.

D. ACCESS newsletters.

3. RESEARCH REPORTS

A. What Do Workers Have to Say? Skills and Technological Change.

B. Access, Equity and Opportunity--Women in Machining: A Model Program.

4. CONFERENCE ACTIVITIES

A. Report: **Opening Doors in the Nineties: Workers, Skills, and Diversity.**

B. Video: **Opening Doors in the Nineties: Workers, Skills, and Diversity.**

5. EVALUATION

A. Independent Evaluation of Project CREATE prepared by the Donahue Institute, University of Massachusetts, Amherst.

TRAINING COURSE OUTLINES

AUTOMOTIVE:

PHASE ONE: ELECTRICITY & ELECTRONICS
PHASE TWO: GENERAL MOTORS SPECIFIC

MACHINING:

COMPUTER NUMERICAL CONTROL MACHINE REPAIR
WMPI BASIC MACHINING COMPETENCY OUTLINE

PRINTING/GRAPHIC ARTS:

SPRINGFIELD PUBLIC SCHOOLS: 90 HOUR BASIC
INDUSTRIAL SERVICES PROGRAM: 200 HOUR BASIC

PROJECT **CREATE**

PHASE ONE 1989 - 1990
AUTOMOTIVE ELECTRICITY & ELECTRONICS
COURSE OUTLINE

TEXT FOR COURSE: AUTOMOTIVE ELECTRICITY AND ELECTRONICS
AUTHOR: AL SANTINI
PUBLISHER: DELMAR PUBLISHERS, INC.
TWO COMPUTER DRIVE, WEST
BOX 15-015
ALBANY, NEW YORK 12212
TELEX 386411

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1. **VOLTAGE, AMPERAGE AND RESISTANCE**
   - ELECTRICAL TERMS
   - OHM'S LAW
   - RELAYS
   - CIRCUITS

2. **METER FUNDAMENTALS**
   - VOLTMETERS
   - AMMETERS
   - OHMMETERS
   - OSCILLOSCOPES

3. **CIRCUITS**

4. **ELECTRONICS FUNDAMENTALS**
   - CONDUCTORS
   - NONCONDUCTORS
   - SEMI-CONDUCTORS
   - DIODES
   - PNP TRANSISTOR
   - NPN TRANSISTOR
   - USING TEST EQUIPMENT

5. **WIRING DIAGRAMS**
   - COMMON SYMBOLS
   - COMMON POINT DIAGNOSIS
   - LOCATION CODES
   - MAJOR AUTOMOTIVE MANUFACTURER/AFTERMARKET WIRING DIAGRAMS

6. **BATTERIES**
   - PRIMARY/SECONDARY CELL
   - SERIES/PARALLEL VOLTAGE
   - RATING
   - STATE OF CHARGE
   - CORRECT CHARGE
   - CORRECT SIZE
   - JUMP START
   - MAINTENANCE
   - REPLACE SPECIFIC GRAVITY
   - CAPACITY CORRECT LOAD
   - SAFETY

7. **STARTING SYSTEMS**
   - MAGNETIC PRINCIPLES
   - BENDIX DRIVE
   - OVER RUNNING CLUTCH
   - SOLENOIDS
   - POSITIVE ENGAGEMENT STARTER
   - NEUTRAL SAFETY SWITCH
   - STARTING RELAY
   - WIRING DIAGRAMS
   - TESTING AND SERVICE MEASURE
   - REPLACE
   - DIAGNOSE

8. **CHARGING SYSTEMS**
   - IDENTIFY
   - EXPLAIN HOW SYSTEM FUNCTIONS EFFECTIVELY
   - HOW TO REGULATE AND CONTROL

9. **VEHICLE CHARGING, SYSTEM TESTING AND SERVICE**
   - TESTING BATTERY
   - ALTERNATOR/REGULATOR OPERATION
   - REPLACE DIODE TRIO
   - BRUSHES, BEARINGS
   - DIODES

10. **IGNITION SYSTEMS**
    - SPARK PLUGS
    - ELECTRONIC IGNITION
    - HIGH-VOLTAGE SPARK AND CORRECT TIME
    - USE: FEELER GAUGE; TACH DWELLMETER; TIMING LIGHT/ADVANCED TL; AND OSCILLOSCOPE
    - APPROPRIATE DIAGNOSTIC EQUIPMENT

11. **ACCESSORIES**
    - LIGHTING CIRCUITS HORN WIPERS DEFOGGERS POWER WINDOWS FANS STANDARD AC

PROJECT **CREATE**
PHASE TWO 1989 - 1990
GENERAL MOTORS SPECIFIC
COURSE OUTLINE

TEXTS FOR COURSE: (1) FUNDAMENTAL OF COMPUTER COMMAND CONTROL
(2) FUEL INJECTION
(3) GM DISTRIBUTORLESS IGNITION SYSTEMS
(4) 1981-86 CCC PERFORMANCE DIAGNOSIS

DISTRIBUTOR: ATTEN: GM TRAINING MATERIALS MERCHANDISING
KENT-MOORE TOOL & EQUIPMENT DIVISION
SPX CORPORATION
28635 MOUND ROAD
WARREN, MI 48092-9923 1-800-468-6657

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1. H.E.I. SYSTEMS (HIGH ENERGY IGNITION SYSTEMS)
A. COMPONENTS
COMPONENT LOCATION
COMPONENT TESTING
COMPONENT FUNCTIONS

2. C.C.C. (COMPUTER COMMAND CONTROL)
A. COMPONENTS
COMPONENT LOCATIONS
COMPONENT TESTING
COMPONENT FUNCTION
ON-CAR TESTING OF COMPONENTS
COMPUTER CODE IDENTIFICATION

3. COMPUTER SCANNER PROCEEDURES

4. T.B.I. SYSTEMS (THROTTLE BODY INJECTION SYSTEMS)
A. COMPONENTS
COMPONENT LOCATION
COMPONENT TESTING
COMPONENT FUNCTION
ON-CAR TESTING OF COMPONENTS

5. FUEL DELIVERY SYSTEMS
A. COMPONENTS
COMPONENT LOCATION
COMPONENT TESTING

COMPONENT FUNCTION
ON-CAR TESTING OF SYSTEM

6. P.F.I. SYSTEM (PAT FUEL INJECTION SYSTEM)

A. COMPONENTS

COMPONENT LOCATION
COMPONENT TESTING
COMPONENT FUNCTIONS
ON-CAR SYSTEM TESTING

7. TROUBLESHOOTING C.C.C. SYSTEMS

A. COMPONENTS

UNDERSTANDING TROUBLE CODES
ELECTRICAL INPUTS IN SYSTEMS
UNDERSTANDING ELECTRICAL DIAGRAMS
FOLLOWING TROUBLE CODE DIAGNOSTIC GLOW CHARTS

8. EMISSION CONTROL SYSTEMS

A. COMPONENTS

COMPONENT LOCATIONS
COMPONENT TESTING
COMPONENT FUNCTIONS
ON-CAR COMPONENT TESTING & SERVICING

9. AIR MANAGEMENT SYSTEMS

COMPONENTS

COMPONENT LOCATIONS
COMPONENT FUNCTIONS
COMPONENT TESTING
ON-CAR COMPONENT TESTING & SERVICING

10. D.I.S. SYSTEMS (DISTRIBUTORLESS IGNITION SYSTEMS)

COMPONENTS

COMPONENT LOCATIONS
COMPONENT FUNCTIONS
COMPONENT TESTING
ON-CAR COMPONENT TESTING

11. TROUBLESHOOTING D.I.S. SYSTEMS

COMPONENTS

UNDERSTANDING ELECTRICAL CIRCUITS
UNDERSTANDING COMPUTER ELECTRICAL RESPONSES
APPLICATION OF COMPUTER INPUT & OUTPUT DATA IN SYSTEM

PROJECT **CREATE** &
SPRINGFIELD TECHNICAL COMMUNITY COLLEGE
COMPUTER NUMERICAL CONTROL MACHINE TOOL REPAIR
COURSE OUTLINE*

COURSE OUTLINE BY WEEK:

1. BASIC ELECTRICITY 1 AND MACHINING FUNDAMENTALS
2. BASIC ELECTRICITY 1 AND MACHINING FUNDAMENTALS
3. BASIC ELECTRICITY 1 AND MACHINING FUNDAMENTALS
4. BASIC ELECTRICITY 1 AND MACHININ[illegible]AMENTALS
5. MICROCOMPUTER PROGRAMMING AND MACHINING FUNDAMENTALS
6. BASIC ELECTRICITY 2 AND MACHINING FUNDAMENTALS
7. BASIC ELECTRICITY 2 AND CNC PROGRAMMING
8. BASIC ELECTRICITY 2 AND CNC PROGRAMMING
9. BASIC ELECTRICITY 2 AND CNC PROGRAMMING
10. SEMICONDUCTORS AND CNC PROGRAMMING
11. SEMICONDUCTORS AND CNC PROGRAMMING
12. SEMICONDUCTORS AND CNC PROGRAMMING
13. INDUSTRIAL ELECTRONICS AND FLUID POWER
14. INDUSTRIAL ELECTRONICS AND FLUID POWER
15. INDUSTRIAL AND DIGITAL ELECTRONICS
16. DIGITAL ELECTRONICS AND OP-AMPS
17. DIGITAL ELECTRONICS AND OP-AMPS
18. MOTOR CONTROLS AND MICROPROCESSORS
19. MOTOR CONTROLS AND MICROPROCESSORS
20. MOTOR CONTROLS AND TROUBLESHOOTING LAB
21. TROUBLESHOOTING LAB

*SEE CNC CURRICULUM FOR COMPREHENSIVE OUTLINE

WESTERN MASS.
PRECISION
INSTITUTE, INC.

TRAINING PROGRAM COMPETENCY OUTLINE

TRAINING PROGRAM COMPETENCY OUTLINE

I. Safety
   - A. Ability to work safely
   - B. Ability to keep a clean, orderly work area

II. Math
   - A. General Math
     1. Whole numbers
     2. Fractions and mixed numbers
     3. Decimals
     4. Powers and roots
   - B. Algebra
   - C. Calculators
   - D. Fundamentals of plane geometry
   - E. Practical trigonometry
   - F. Speeds and feeds

III. Blueprint reading
   - A. Introduction to industrial drawings
   - B. Principles of orthographic projection
   - C. Family of lines
   - D. Symbols and abbreviations
   - E. Dimensioning and tolerances
   - F. Blueprint interpretations
   - G. Sketching

IV. Identification and classification of metals
   - A. SAE and AISI classification code
   - B. Color code for steel
   - C. Spark test
   - D. Understanding ferrous metals
   - E. What are nonferrous metal?

V. Basic metallurgy & heat treatment
   - A. Purpose of heat treatment
   - B. How carbon affects hardening
   - C. How to harden carbon steel
   - D. How to temper carbon tool steel

E. How to case harden low carbon steel
   1. Pack carburizing
   2. Gas carburizing
   3. Liquid carburizing

F. Hardness testing

VI. Benchwork

A. Measuring tools
   1. Measuring responsibility
   2. Reliability and descrimination of measuring tools
   3. Semi-Precision
      a. rules
      b. Combination square
      c. Transfer tools
   4. Precision
      a. Micrometers
      b. Verniers
      c. Dial indicators
      d. Gage blocks
      e. Bevel protractor
      f. Sine bar

B. Noncutting tools
   1. Hammers
   2. Wrenches
   3. Screwdrivers
   4. Clamping & gripping devices

C. Cutting & shaping hand tools
   1. Files
   2. Chisels
   3. Punches
   4. Hacksaws
   5. Taps and dies
   6. Abrasives

VII. Pedestal grinders

A. Safe operating habits

B. Care and maintenance

C. Grinding wheel
   1. Testing
   2. Mounting
   3. Dressing

D. Grinding
   1. Tool bits (definition)
   2. Cutting tool materials
   3. Single-point cutting tool terms
   4. Understanding tool angles
   5. Grinding right-hand turning tools
   6. Grinding right-hand side facing tools
   7. Cut off tools
   8. Grinding threading tools
   9. Drill bits

VIII. Band saws
   A. Safe operating habits
   B. Care and maintenance
   C. Blade speed
      1. Selecting
      2. Setting
   D. Mounting Blade
   E. Setting guides and stock stop
   F. Cutting material to length
   G. Welding Blade
   H. Contouring saws to layout line
   I. Removing and storing blade

IX. Cutting fluids
   A. Mixing cutting fluids
   B. Selecting proper cutting fluids
   C. Properly applying cutting fluids

X. Drilling machine
   A. Safe operating habits
   B. Care and maintenance
   C. Types

D. Work holding devices
E. Speeds and feeds
F. Center drilling
G. Drilling holes
H. Reaming
I. Tapping
J. Boring
K. Counterboring
L. Countersinking

XI. Engine lathe
A. Safe operating habits
B. Care and maintenance
C. Historical Background
D. Identifying Major parts
E. How a lathe operates
F. Recognizing lathe accessories
G. Determining speeds and feeds

XII. Lathe operations
A. How to mount and remove lathe chucks
B. How to mount and true up work in four-jaw chuck
C. How to face and turn work mounted in a lathe chuck
D. How to make roughing and finishing cuts
E. How to knurl a piece of mild steel
F. How to neck and part a workpiece
G. How to drill and ream in a lathe
H. How to bore work mounted in a lathe
I. How to mount work between lathe centers
J. How to remove unwanted taper using an indicator
K. How to face work mounted between centers
L. How to turn tapers
1. Simple taper turning with compound
2. Offset tailstock method
3. Turning a taper with taper attachment

M. How to cut threads in a lathe
   1. Calculations for screw threads
   2. Procedure using a threading dial
   3. Resetting tool after its removal
   4. Cutting left-hand threads
   5. Thread measurement
      a. Fixed gages
      b. Thread micrometer
      c. 3-wire method
   6. Procedure for internal threads

XIII. The vertical milling machine and its operation
   A. Safe operating habits
   B. Care and maintenance
   C. Identifying parts and controls
   D. How a vertical knee-and-column milling machine operates
   E. Recognizing milling machine accessories
   F. determining cutting speeds and feeds
   G. Understanding climb and conventional milling
   H. Dealing with backlash
   I. Tramming the head of a bridgeport
   J. Indicating a vise
   K. How to mill a flat surface
   L. How to square stock
   M. Milling simple angles
   N. How to use the edge finder
   O. Establishing true position with indicator
   P. How to mill an elongated slot
   Q. Centerdrilling, drilling, reaming, countersinking, counterboring, and tapping
   R. Drilling holes on a bolt circle using rotary table
   S. Contour milling

XIV. Milling cutters and holders
   A. Cutter materials
   B. Recognizing the many types of milling cutters
   C. Hand of a milling cutter

D. Care of milling cutters
E. Means of holding cutters
F. Understanding face and peripheral milling
G. Chip load/impact loading

XV. The horizontal milling machine
A. Identifying major parts
B. Identifying parts and controls
C. How the horizontal milling machine operates
D. Recognizing accessories

XVI. Surface grinder
A. Safe operating habits
B. Care and maintenance
C. Identifying major parts
D. Identifying parts and controls
E. How a surface grinder operates
F. Recognizing accessories

XVII. Grinding wheel preparation
A. Care and safety
B. Grinding wheel selection
1. Kinds of abrasives
2. Grain size
3. Grade or hardness
4. Structure
5. Bond types
C. Mounting grinding wheels
D. truing and dressing wheels
E. Selecting grinding fluids
F. Surface finish

XVIII. Grinding operations
A. Grinding a flat surface
B. How to grind square and parallel
C. Grinding a verticle surface
D. Grinding on angular surface
E. Cutting-off operations

SKILLS UPGRADING FOR THE PRINTING INDUSTRY
90 HOUR BASIC PRINTING SKILLS COURSE
SKILLS UPGRADING CURRICULUM
JANUARY 23 - MAY 16, 1990

A COLLABORATIVE ENDEAVOR BETWEEN

****

THE SPRINGFIELD BUREAU OF ADULT EDUCATION

AND

PROJECT CREATE,

HAMPDEN COUNTY EMPLOYMENT & TRAINING CONSORTIUM

Project CREATE and this training was provided by
The U.S. Department of Education
Office of Adult and Vocational Education

ROGER L. PUTNAM VOCATIONAL TECHNICAL HIGH SCHOOL

COURSE OUTLINE

PRINT SHOP

OFFSET: CAMERA

I. The Process Camera (General)

- A. Definition of photography
- B. Types of cameras
- C. The camera assembly
- D. The copyboard and its accessories
- E. The camera bellows
- F. Front case assembly (lensboard; shutter)
- G. The back of the camera assembly
- H. Loading the camera and controls

II. Orientation to the Darkroom

- A. Types of darkrooms
- B. The darkroom entrance
- C. The lighting system to the darkroom
- D. Organization and equipment
- E. Ventilation, Air Conditioning and Lighting
- F. Safety and maintenance

III. Copy to Photograph

- A. Classes of copy
- B. Examination of copy
- C. Preparation of copy
  - 1. Scaling copy
  - 2. Arranging copy
- D. Filters: definition and use

IV. Selection of Film

- A. Physical and photographic properties
- B. Film: Emulsions and Bases
- C. Factors in selecting film for the job
- D. Data Sheets
- E. Handling unexposed film

V. Focusing the Camera (Manual or Automatic)

- A. How the image is formed by the camera
- B. The process lens
- C. Focusing scale

VI. Illumination of Copy for Exposure

A. Illumination principles
B. Types of illumination for photography
C. Placement of light source

VII. Making the Exposure

A. Exposure: purpose, factors, controls
B. Standardizing exposures
C. Preparation of processing materials
D. The standard exposure strip
E. Exposure changes (same size, reduction, enlargement)
F. Effect of light on film
G. Loading the camera

VIII. Film Chemistry (Processing)

A. Types of developer
B. Methods of developing and inspecting
C. Effect of development
D. Stop bath
E. Fixing the image
F. Washing of processed film
G. Drying of process film
H. Evaluating film
I. Etching (reducing)
J. Handling of developed film

IX. Basic Halftone Photography

A. Halftone Screens
   1. Basic function
   2. Types of and purposes
B. Characteristics of a Halftone Negative
   1. Highlights
   2. Midtones
   3. Shadows
C. Making a Halftone Negative
   1. Meaning of density, tone and value
   2. The densitometer
   3. Setting lens
   4. Highlight exposure
   5. Main exposure
   6. Flash exposure
   7. Types of developing (still, agitate)
   8. Processor
D. Duotones
   1. Definition
   2. Types
   3. Screen angles

PRESSWORK

I. Safety

A. During operation of presses
B. Maintenance
C. Housekeeping
D. Chemicals
E. Clothing

II. Introduction to Offset Presses

A. Single color - Sheet Fed
B. Duplicators

III. The Printing Unit

A. Plate Cylinder
B. Blanket Cylinder
C. Impression Cylinder
D. Operation

IV. The Inking System

A. Setting Fountain
B. Roller Settings
C. Amount of ink feed
D. Roller Care

V. Dampening Systems

A. Molleton
B. 3"m" sleeve
C. Aqua-matic System (A.B. Dick)
D. Maintenance
E. Settings

IV. Feeders

A. Function
B. Operation

VII. Register

A. Single Color
B. Multi Color
C. Makeready

VIII. Delivery

A. Function
B. Chain Type
C. Ejector Type
D. Joggers

IX. Blankets

A. Function
B. Types
C. Maintenance
D. Repairs

X. Packing

A. Purpose
B. Materials

XI. Litho Plates

A. Handling
B. Mounting
C. Plate Troubles
D. Ph Control
E. Running the Plate
F. Scumming and tinting

XII. Paper

A. Weight
B. Quality
C. Moisture
D. Static (dryness)
E. Jogging
F. Loading Feeders
G. Troubles

XIII. Inks

A. Types
B. Oxidation drying
C. Absorbtion drying
D. Color Control
E. Mixing
F. Troubles

XIV. Press Washup

A. Automatic
B. Manual
C. Chemicals
D. Conditioners

XV. Maintenance

A. Daily
B. Weekly
C. Semi-annual

XVI. Tools and Guages

A. Linen Testers
B. Micrometers
C. PH Tester
D. Hand Tools

BINDERY

I. Paper cutter

A. Settings (manual, auto program)
B. Paper grain and types of paper
C. Figuring paper
D. Gripper and guide

II. Collator

A. Set-up-Sheet Unit
B. Stitcher unit
C. Fold unit
D. Trim unit

III. Folder

A. Set-up - pressures
B. Various folds
C. Fold plates
D. Signatures

IV. Paper Drill and Stitcher

A. Set-up
B. Pressures

JOB ENTRY LEVEL
GRAPHIC ARTS
ADULT TRAINING PROGRAM
Sponsored by:

Project CREATE and the Industrial Services Program

The Wm. J. Dean Technical School, in cooperation with Project CREATE, and the Industrial Services Program, will offer an adult training program in the field of graphic arts. The program will consist of 200 hours of training in a variety of graphic arts and printing related skills. Training sessions for a limited enrollment will be offered from 2:30 to 7:30 Monday through Thursday. The training sessions will begin on February 5, 1990 and continue for 10-12 weeks. A **CERTIFICATE of COMPLETION** will be issued as evidence of achievement in this competency based course. In addition to an introduction to the career opportunities in printing and an explanation of the work processes involved in the trade area, the course will cover the following topics.

CONSTRUCTION AND LAYOUT DESIGN:

Identification of fonts, their characteristics, and usage in design and layout; image generation; photographic and strike on composition; use of photographs and text in rough preparation; selection of paper stock, ink types and colors; stripping and flat preparation; outlining; use of half tones; multicolor layout; tinting; and reverse overprint. Equipment training will include Compu-graphic, Itek, and MacIntosh type setting systems.

40 HRS

CAMERA OPERATION:

Darkroom operations camera usage; film processing and proofing; plate making; and camera maintenance. Training will include operation of the Itek camera system and Nu-arc plate maker/camera systems.

30 HRS

PRESS OPERATION:

Instruction in offset and letter press set-up with production operation; training with Hamada, Multi-graphic 1650, and A B Dick offset presses; training with Heidelberg letter presses; multicolor instruction with the Solna 225 system. Production maintenance procedures for all machines will be included in the training process.

100 HRS

BINDERY OPERATIONS:

Instruction in operation and maintenance of parallel and right angle folders; the paper drill; side and saddle stitchers; cutting and trimming equipment; and the perfect binding process.

30HRS

TRAINING:

HOURS & ETHNICITY

1989 - 1990

CLASS NAME	REQ ENROLLED	ACT ENROLLED	REQ TRNG HRS	ACT TRNG HRS
AUTO PHASE 1 '89	20	22	40	40
AUTO PHASE 1 '90	0	21	50	54
AUTO PHASE 2 '90	0	23	0	54
AUTO PHASE 2/2 '90	0	21	0	54
TOTAL	20	87	90	202
DEAN/ISP PRINTING	0	14	0	200
TOTAL	0	14	0	200
PUTNAM PRINTING	20	25	75	90
TOTAL	20	25	75	90
STCC CNC REPAIR	10	21	96	160
TOTAL	10	21	96	160
WMPI MACHINE	20	20	480	480
TOTAL	20	20	480	480
GRAND TOTAL	70	167	741	1,132
ACTUAL PERCENT	100	239	100	153

1989 - 1990

COURSE	ENTERED	DROP	COMPLETE	M	F	WM	WF	HM	HF	BM	BF	OTHER
AUTO PHASE 1 '89	22	5	17	21	1	13	1	7	-	1	-	-
AUTO PHASE 1 '90	21	8	13	20	1	17	1	3	-	-	-	-
AUTO PHASE 2 '90	23	1	22	22	1	16	1	4	-	1	-	1 NAT. AMERICAN
AUTO PHASE 2/2 '90	21	2	19	21	-	18	-	3	-	-	-	
DEAN/I.S.P. PRINTING*	14	2	12	8	6	8	6	-	-	-	-	-
PUTNAM PRINTING*	25	8	17	19	6	14	3	2	1	3	2	-
STCC CNC REPAIR	21	3	18	21	-	18	-	1	-	1	-	1 ARABIC
WMPI MACHINING	20	12	8	20	-	17	-	2	-	1	-	-
TOTAL	167	41	126	150	15	121	12	22	1	7	2	2
PERCENT	100	24	76	89	11	72	8	13	.006	5	1	1

M=MALE F=FEMALE WM=WHITE MALE WF=WHITE FEMALE
HM=HISPANIC MALE HF=HISPANIC FEMALE BM=BLACK MALE
BF=BLACK FEMALE

*Seventeen dislocated workers were enrolled in the Dean/ISP and Putnam printing and graphic arts training programs.

STUDENT COURSE EVALUATIONS

INTERIM/FINAL

PROJECT CREATE STUDENT COURSE EVALUATION 1989-1990
INTERIM SURVEY

Dear student:

Please take a moment to complete the following questions and return this survey to your instructor. Your answers will help us to evaluate how well the course is going so far and to adjust the course to better suit the needs of the class. Thank you.

Yours truly,

Project CREATE staff

Date:
Course: **Instructor:**

Please evaluate the following aspects of the training so far:

	EXCELLENT	GOOD	UNCERTAIN	FAIR	POOR
1. Training course overall.	1	2	3	4	5
2. Course content.	1	2	3	4	5
3. Presentation of course material.	1	2	3	4	5
4. Hands-on instruction.	1	2	3	4	5
5. Hands-on practice.	1	2	3	4	5
6. Training manuals.	1	2	3	4	5
7. Length of course per night.	1	2	3	4	5
8. Availability of instructor for questions or clarification.	1	2	3	4	5
9. Review of materials.	1	2	3	4	5

(continued on next page)

Please circle the number that best describes how you feel about the following statements:

	STRONGLY DISAGREE	DISAGREE	UNSURE	AGREE	STRONGLY AGREE
10. There is enough class time for the instructor to present the material.	1	2	3	4	5
11. There is enough time for hands-on practice.	1	2	3	4	5
12. There is enough time for hands-on instruction.	1	2	3	4	5
13. The course work is at the right level of difficulty for me.	1	2	3	4	5
14. The course work is too easy for me.	1	2	3	4	5
15. I have trouble keeping up with the instructor.	1	2	3	4	5
16. I have trouble keeping up with the class.	1	2	3	4	5
17. I am receiving enough one to one instruction.	1	2	3	4	5
18. The instructor is available to answer questions.	1	2	3	4	5

19. What suggestions do you have for improving the course?

PROJECT CREATE STUDENT COURSE EVALUATION SURVEY 1989-1990

Dear student:

Please take a moment to complete the following questions and return this survey to your instructor. Your answers will help us to improve the quality of training programs funded by Project CREATE.

Yours truly,

Project CREATE staff

Date:
Course: **Instructor:**

Please evaluate the following aspects of the training:

	EXCELLENT	GOOD	UNCERTAIN	FAIR	POOR
1. Training course overall.	1	2	3	4	5
2. Course content.	1	2	3	4	5
3. Presentation of course material.	1	2	3	4	5
4. Hands-on instruction.	1	2	3	4	5
5. Hands-on practice.	1	2	3	4	5
6. Training manuals.	1	2	3	4	5
7. Length of course per night.	1	2	3	4	5
8. Overall length of course.	1	2	3	4	5
9. Availability of instructor for questions or clarification.	1	2	3	4	5
10. Review of materials.	1	2	3	4	5

(continued on next page)

Please circle the number that best describes how you feel about the following statements:

	STRONGLY DISAGREE	DISAGREE	UNSURE	AGREE	STRONGLY AGREE
11. The training provided me with skills that I could use right away on my job.	1	2	3	4	5
12. There was enough class time for the instructor to present the material.	1	2	3	4	5
13. There was enough time for hands-on practice.	1	2	3	4	5
14. There was enough time for hands-on instruction.	1	2	3	4	5
15. The course work was at the right level of difficulty for me.	1	2	3	4	5
16. The course work was too easy for me.	1	2	3	4	5
17. I had trouble keeping up with the instructor.	1	2	3	4	5
18. I had trouble keeping up with the class.	1	2	3	4	5
19. I learned a lot from taking the training.	1	2	3	4	5
20. I received enough one to one instruction.	1	2	3	4	5

(continued on next page)

	STRONGLY DISAGREE	DISAGREE	UNSURE	AGREE	STRONGLY AGREE
21. The instructor was available to answer questions.	1	2	3	4	5
22. The students broke into groups by race or ethnicity.	1	2	3	4	5
23. The students broke into groups by male/female.	1	2	3	4	5
24. The students broke into groups according to language differences.	1	2	3	4	5
25. The students formed a group as a whole.	1	2	3	4	5
26. The material was reviewed as much as I needed.	1	2	3	4	5
27. My supervisor has assigned me work that reflects my new skills and abilities.	1	2	3	4	5
28. My employer has asked me about the course and my progress in it.	1	2	3	4	5
29. I am interested in attending future training programs.	1	2	3	4	5

30. **What was the most positive benefit of the training program?**

(continued on next page)

31. **What was the most negative aspect of the training program?**

32. **What suggestions would you make for future training programs?**

33. **What training programs would you like to attend in the future?**

34. **What is the most important skill you have acquired in this course that you are <u>now</u> using on the job?**

(continued on next page)

PLEASE ANSWER THE FOLLOWING QUESTIONS. THE INFORMATION WILL BE USED SOLELY FOR THE PURPOSES OF EXAMINING THE COMPOSITION OF THE CLASS AND FOR EFFECTIVE TARGETTING OF FUTURE RECRUITMENT EFFORTS.

A. Are you presently employed?_____ B. Laid-off?_____ C. Welfare?___

D. Employer (if employed)_____

E. Years at present workplace____ F. Years in the trade____

G. Present position_____ H. Age____ I. Sex: M F

J. Race/Ethnicity:
(please check one)

__ Black/Non-Hispanic
__ White/Non-Hispanic
__ Hispanic
__ Native American
__ Asian
__ Other_____

K. Education:
(check highest level completed)

__ High school grad/highest grade completed____
__ GED diploma
__ Trade school/vocational H.S. graduate
__ Some college
__ College graduate (degree_____)

L. Prior education and/or training <u>in this field</u>:
(please check as many as are relevant)

__ no prior education or training
__ armed services
__ community college
__ adult vocational training program
__ apprenticeship program
__ industry/manufacturer sponsored training
__ other (please explain)_____
_____
__ trade school
__ vocational-technical high school
__ other college
__ on the job training

PROJECT CREATE STUDENT COURSE EVALUATION
INTERIM SURVEY TABLE

Date:
Course: **Instructor:**
Total N:

	EXCELLENT		GOOD		UNCERTAIN		FAIR		POOR	
	n	%	n	%	n	%	n	%	n	%
1. Training course overall.										
2. Course content.										
3. Present course material.										
4. Hands-on instruction.										
5. Hands-on practice.										
6. Training manuals.										
7. Length of course per night.										
8. Availability of instructor for questions or clarification.										
9. Review of materials.										

	STRONGLY DISAGREE		DISAGREE		UNSURE		AGREE		STRONGLY AGREE	
	n	%	n	%	n	%	n	%	n	%
10. There is enough class time for the instructor to present the material.										
11. There is enough time for hands-on practice.										
12. There is enough time for hands-on instruction.										
13. The course work is at the right level of difficulty for me.										

	STRONGLY DISAGREE		DISAGREE		UNSURE		AGREE		STRONGLY AGREE	
	n	%	n	%	n	%	n	%	n	%
14. The course work is too										
15. I have trouble keeping up with the instructor.										
16. I have trouble keeping up with the class.										
17. I am receiving enough one to one instruction.										
18. The instructor is available to answer questions.										

19. What suggestions do you have for improving the course?

	n	%
1. _____		
2. _____		
3. _____		
4. _____		
5. _____		

HIGH-TECH '90 STUDENT COURSE EVALUATION
FINAL SURVEY TABLE

Date:
Course: **Instructor:**
Total N:

	EXCELLENT		GOOD		UNCERTAIN		FAIR		POOR	
	n	%	n	%	n	%	n	%	n	%
1. Training course overall.										
2. Course content.										
3. Presentation course material.										
4. Hands-on instruction.										
5. Hands-on practice.										
6. Training manuals.										
7. Length of course per night.										
8. Overall length of course.										
9. Availability of instructor for questions or clarification.										
10. Review of materials.										

	STRONGLY DISAGREE		DISAGREE		UNSURE		AGREE		STRONGLY AGREE	
	n	%	n	%	n	%	n	%	n	%
11. The training provided me with skills that I could use right away on my job.										
12. There was enough class time for the instructor to present the material.										
13. There was enough time for hands-on practice.										

	STRONGLY DISAGREE		DISAGREE		UNSURE		AGREE		STRONGLY AGREE	
	n	%	n	%	n	%	n	%	n	%
14. There was enough time for hands-on instruction.										
15. The course work was at the right level of difficulty.										
16. The course work was too easy for me.										
17. I had trouble keeping up ≥with the instructor.										
18. I had trouble keeping up with the class.										
19. I learned a lot from taking the training.										
20. I received enough one to one instruction.										
21. The instructor was available to answer questions.										
22. The students broke into groups by race or ethnicity.										
23. The students broke into groups by male/female.										
24. The students broke into groups according to language differences.										
25. The students formed a group as a whole.										
26. The material was reviewed as much as I needed.										
27. My supervisor has assigned me work that reflects my new skills and abilities.										

	STRONGLY DISAGREE n %	DISAGREE n %	UNSURE n %	AGREE n %	STRONGLY AGREE n %
28. My employer has asked me about the course and my progress in it.					
29. I am interested in attending future training programs.					

30. What was the most positive benefit of the training program?

	n	%
1.		
2.		
3.		
4.		
5.		

31. What was the most negative aspect of the training program?

	n	%
1.		

(question 31 cont'd)

n %

2. _____

3. _____

4. _____

5. _____

32. What suggestions do you have for future training programs?

n %

1. _____

2. _____

3. _____

4. _____

5. _____

33. What future training programs would you like to attend?

n %

1. _____
2. _____
3. _____
4. _____
5. _____

34. What is the most important skill you have acquired in this course that you are <u>now</u> using on the job?

n %

1. _____
2. _____
3. _____
4. _____

(question 34 cont'd)

	n	%
_____		
_____		
5_____		
_____		
_____		

POST-TRAINING QUESTIONNAIRES

TRAINEE/SUPERVISOR

CREATE SKILLS-TRAINING QUESTIONNAIRE
POST-TRAINING QUESTIONS FOR TRAINEES

FIRM/COMPANY _____

ADDRESS _____

_____

FOREMAN/SUPERVISOR _____

DATE OF INTERVIEW _____ BEGAN INTERVIEW _____

END INTERVIEW _____

NO. EMPLOYEES IN FIRM _____

PERCENT OF EMPLOYEES WITH:
(ESTIMATES)

BELOW AVERAGE SKILLS (FOR THE INDUSTRY) ____%

AVERAGE SKILLS (FOR THE INDUSTRY) ____%

ABOVE AVERAGE SKILLS (FOR THE INDUSTRY) ____%

WHICH INDUSTRY:

AUTOMOTIVE _____ MACHINING _____ PRINTING _____

CREATE SKILLS-TRAINING QUESTIONNAIRE
POST-TRAINING QUESTIONS FOR TRAINEES

PLEASE CIRCLE THE ANSWER THAT BEST DESCRIBES HOW YOU FEEL ABOUT THE FOLLOWING QUESTIONS:

1. Since completing training, have you had the opportunity to use your new skills? If yes, how? YES UNSURE* NO

2. Has your employer assigned you duties that utilize your new skills? If yes, how? YES UNSURE* NO

3. Did you receive a pay raise due to your new skills? YES UNSURE* NO

4. **WHAT NEW SKILLS DO YOU PRESENTLY UTILIZE THE MOST?**

5. **WHAT ADDITIONAL SKILLS DO YOU NEED TO ACQUIRE IN ORDER TO PROGRESS IN YOUR FIELD?**

6. Do you know where to acquire these skills? YES UNSURE* NO

7. **IF YOU'RE NOT USING YOUR NEW SKILLS, HOW LONG WILL IT TAKE BEFORE YOU WILL FORGET THE KNOWLEDGE YOU'VE GAINED?**

8. Did you have any expectations of the training course? YES UNSURE* NO

9. Did the training course fulfill your expectations? YES UNSURE* NO

10. **IF NO TO QUESTION NINE, HOW DID THE COURSE FAIL YOU?**

11. Do you want to attend additional training courses? YES UNSURE* NO

12. Were you well prepared for training? YES UNSURE* NO

13. Do you feel you needed any pre-training courses before entering into your area of study? Which ones? YES UNSURE* NO

14. If English is not your native language, did you have trouble with the language? YES UNSURE* NO

15. Did you have trouble understanding the technical language of your profession? YES UNSURE* NO

16. Did you have trouble keeping up with the class? If yes, why? YES UNSURE* NO

17. Did your employer/supervisor take an interest in your training? YES UNSURE* NO

18. Has your employer supported your progress? YES UNSURE* NO

19. WHAT SUGGESTIONS DO YOU HAVE FOR PREPARING NEW STUDENTS FOR TRAINING?

20. Do you have on-the-job-training at your work? YES UNSURE* NO

21. Have you taken any courses, since completion of training, to upgrade your job skills? YES UNSURE* NO

22. If yes to question twentyone, what course (s) are they, and from what training institution? YES UNSURE* NO

23. Was it worthwhile participating in this CREATE training program? If yes, in what ways? YES UNSURE* NO

24. Do you feel having students with you in the same class, with different levels of experience, was the most effective way to teach? YES UNSURE* NO

25. **WHAT OBSERVATIONS OR IDEAS DO YOU HAVE THAT WOULD MAKE TRAINING MORE EFFECTIVE FOR YOU?**

CREATE SKILLS-TRAINING QUESTIONNAIRE
POST-TRAINING QUESTIONS FOR
FOREMAN/SUPERVISOR

FIRM/COMPANY _____

ADDRESS _____

_____

FOREMAN/SUPERVISOR _____

DATE OF INTERVIEW _____ BEGAN INTERVIEW _____

END INTERVIEW _____

NO. EMPLOYEES IN FIRM _____

PERCENT OF EMPLOYEES WITH:
(ESTIMATES)

BELOW AVERAGE SKILLS (FOR THE INDUSTRY) ___%

AVERAGE SKILLS (FOR THE INDUSTRY) ___%

ABOVE AVERAGE SKILLS (FOR THE INDUSTRY) ___%

WHICH INDUSTRY:

AUTOMOTIVE _____ MACHINING _____ PRINTING _____

CREATE SKILLS-TRAINING QUESTIONNAIRE
POST-TRAINING QUESTIONS FOR FOREMAN/SUPERVISOR

PLEASE CIRCLE THE ANSWER THAT BEST DESCRIBES HOW YOU FEEL ABOUT THE FOLLOWING QUESTIONS:

1. Were you able to follow your employee's progress in the training course he/she participated in?	YES	UNSURE*	NO
2. If yes to question 1, do you feel the material that that was taught was relevant to your business needs?	YES	UNSURE*	NO
3. Did this training course provide your employee with skills that could be used immediately on the job?	YES	UNSURE*	NO
4. Did it provide your employee with skills that were usable at all?	YES	UNSURE*	NO
5. Were you able to provide your employee new responsibilities that reflected these increased skills and abilities?	YES	UNSURE*	NO

6. **HAVE YOU EITHER PROMOTED OR GIVEN YOUR EMPLOYEE MORE AUTHORITY AS A RESULT OF THESE NEWLY ACQUIRED SKILLS?** *(IF YES, PLEASE EXPLAIN).*

7. Would you be willing to collaborate on future training programs with other members of your industry?	YES	UNSURE*	NO
8. Would you be willing to pay a registration fee for your employee to take a training course?	YES	UNSURE*	NO
9. Are you willing to give workers paid time off to attend a training course?	YES	UNSURE*	NO
10. Would you be willing to help with the development of curriculum specifically designed for your industry?	YES	UNSURE*	NO
11. Are you willing to provide material in the development of a training program?	YES	UNSURE*	NO

12. Would you be willing to provide a monetary committment in the development of a training program? YES UNSURE* NO

13. Are you willing to send your employees to one of these training programs? YES UNSURE* NO

14. **WHAT TRAINING PROGRAM(S) WOULD BE OF MOST BENEFIT TO YOUR BUSINESS NEEDS?**

---

15. **WHAT ASPECT OF TRAINING WOULD BE MOST BENEFICIAL TO YOUR PERSONAL BUSINESS NEEDS?** *(PLEASE NUMBER YOUR CHOICES, WITH 1 [ONE] BEING RATED AS YOUR FIRST CHOICE, 2 [TWO] YOUR SECOND, ETC.).*

MATH___ **INTERPRETING DIAGRAMS, MANUALS, CHARTS OR BLUEPRINTS**___

COMPUTER LITERACY___ **PROBLEM SOLVING SKILLS**___ **ELECTRONICS**__

LITERACY (READING/WRITING)___ **MACHINE SET-UP**___ **QC/INSPECTION**__

CAD/MACHINE REPAIR___ **OTHER**___ (PLEASE EXPLAIN)_____

---

16. **IF THE TRAINING COURSE YOUR EMPLOYEE ATTENDED PROVIDED NEW, USABLE SKILLS, HOW HAVE YOU INTEGRATED THESE NEWLY LEARNED SKILLS INTO YOUR WORKFORCE?**

AUTOMOTIVE PRE-TESTS

ENGLISH/SPANISH

Pre Test - Phase 1

Circle the correct answer

1. Resistance is measured in
   (A) Volts
   (B) Ohms
   (C) Amps
   (D) None of the above

2. A Voltmeter is always wired in_____with the load.
   (A) Parallel
   (B) Series
   (C) Either series of parallel
   (D) None of the above

3. To find the total current flow in any circuit.
   (A) Multiply amperage by voltage.
   (B) Divide voltage by amperage.
   (C) Multiply voltage by resistance.
   (D) Divide voltage by resistance.

4. Transistors have three leads identified as
   (A) Anode, cathode, gate
   (B) neutral, positive, negative
   (C) Base, omitter, collector
   (D) Negative, positive, negative

5. A low Maintenance battery usually has grids made of
   (A) Calcium
   (B) Antimony
   (C) Glass
   (D) Lead dioxide.

6. Tach dwellmeters are generally attached to the
   (A) Positive coil and ground
   (B) Positive & negative of the coil
   (C) Negative of the coil and ground
   (D) Battery positive and coil positive

7. Vacuum advance compensates for varying
   (A) Engine speeds
   (B) Transmission shifts
   (C) Engine sizes
   (D) Engine loads

The following are True or False (circle the correct one)

8. Grounding the regulator on a GM internally regulated alternator will force it into Full Field oeration. True False

9. A tighter than normal engine will decrease the amperage draw of a starter test. True False

10. Jumper cables are connected to the vehicles dead battery First, when jump starting a car. True False

11. A diode will allow current to flow in only one direction. True False

12. A knock sensor will retard ignition timing until knock is eliminated. True False

13. To initially set timing on a computer controlled engine, the engine must be at a specific speed. True False

Please write the correct answer.

14. What is Ohms Law.

NAME_____ HOME PHONE_____

ADDRESS_____

CITY _____ ZIP_____

EMPLOYER_____

PRE EXAMEN FASE 1

PON UN CIRCULO ALREDEDOR DE LA CONTESTACION CORRECTA

1. LA RESISTENCIA SE MIDE EN ...
   (A) VOLTIOS
   (B) OHMIOS
   (C) AMPERES
   (D) NINGUNA DE LAS ANTERIORES

2. EL METRO DE MEDIR VOLTIOS ES SIEMPRE ALAMBRADO EN _____ CON LA CARGA
   (A) PARALELO
   (B) SERIE
   (C) CUALQUIERA, EN SERIE O PARALELO
   (D) NINGUNA DE ESTAS

3. PARA ENCONTRAR EL TOTAL DE CORRIENTE QUE FLUYE EN UN CIRCUITO, SE HACE LO SIGUIENTE:
   (A) MULTIPLICA EL AMPERAGE POR EL VOLTAGE
   (B) DIVIDE EL VOLTAGE POR EL AMPERAGE
   (C) MULTIPLICA EL VOLTAGE POR LA RESISTENCIA
   (D) DIVIDE EL VOLTAGE POR LA RESISTENCIA

4. LOS TRANSISTORES TIENEN TRES (ELECTRODOS) TERMINALES IDENTIFICADOS COMO:
   (A) ANODO, CATODO, CIRCUITO
   (B) NEUTRAL, POSITIVO, NEGATIVO
   (C) BASE, "OMITTER", COLECTOR
   (D) NEGATIVO, POSITIVO, NEGATIVO

5. LAS PLACAS CONDUCTORAS DE UNA BATERIA DE BAJO MANTENIMIENTO USUALMENTE SON HECHAS DE ...
   (A) CALCIO
   (B) ANTIMONIO
   (C) CRISTAL
   (D) DIOXIDO DE PLOMO

6. EL TACHDWELL METER (TAQUIMETRO) ESTA GENERALMENTE UNIDO A ...
   (A) LA BOBINA POSITIVA Y TIERRA.
   (B) AL POSITIVO Y NEGATIVO DE LA BOBINA.
   (C) NEGATIVO DE LA BOBINA Y TIERRA.
   (D) POSITIVO DE LA BATERIA Y POSITIVO DE LA BOBINA.

7. EL ADELANTO EN EL "VACUUM" COMPENSA LA VARIACION EN ...
   (A) VELOCIDAD DEL MOTOR
   (B) LOS CAMBIOS DE LA TRANSMISION
   (C) TAMAÑO DEL MOTOR
   (D) CARGA DEL MOTOR

LAS SIGUIENTES SON CIERTAS O FALSAS (PON UN CIRCULO ALREDEDOR DE LA CONTESTACION CORRECTA).

8. HACERLE TIERRA AL REGULADOR DE UN ALTERNADOR REGULADO INTERNO DE LA GM LO FORZARA A UN CAMPO COMPLETO DE OPERACION.

CIERTO FALSO

9. UN MOTOR MAS AJUSTADO DE LO NORMAL DISMINUIRA EL AMPERAGE QUE SALE DE UNA PRUEBA DE UN MOTOR DE ARRANQUE.

CIERTO FALSO

10. LOS CABLES DE DAR CORRIENTE ("JUMPEAR") SON CONECTADOS PRIMERO AL CARRO QUE TIENE LA BATERIA MUERTA CUANDO SE VA A DAR CORRIENTE.

CIERTO FALSO

11. UN DIODO PERMITIRA QUE LA CORRIENTE FLUYA EN UNA SOLA DIRECCION.

CIERTO FALSO

12. UN SENSOR DE TUMBE RETRASA EL TIEMPO DE LA IGNICION HASTA QUE EL TUMBE SEA ELIMINADO.

CIERTO FALSO

13. PARA PONER EN TIEMPO POR PRIMERA VEZ LA COMPUTADORA QUE CONTROLA EL MOTOR, EL MOTOR DEBE ESTAR A UNA VELOCIDAD ESPECIFICADA.

CIERTO FALSO

POR FAVOR PONGA LA CONTESTACION CORRECTA

14. QUE ES LA LEY DE OHMIOS

NOMBRE_____ TELEFONO DE LA CASA _____
DIRECCION_____
CIUDAD_____ ZIP CODE _____
PATRONO_____
DIRECCION DEL PATRONO_____
_____
AÑOS DE EXPERIENCIA COMO MECANICO _____

PROJECT CREATE

PHASE ONE
ELECTRICITY & ELECTRONICS
PRE- AND POST-TEST ANSWERS*

CIRCLE THE CORRECT ANSWER

1. (B) Ohms
2. (A) Parallel
3. (D) Divide voltage by resistance
4. (C) Base, ommitter, collector
5. (A) Calcium
6. (C) Negative of the coil and ground
7. (D) Engine loads

TRUE OR FALSE

8.	**TRUE**	FALSE
9.	TRUE	**FALSE**
10.	**TRUE**	FALSE
11.	**TRUE**	FALSE
12.	TRUE	FALSE
13.	**TRUE**	FALSE

WRITE THE CORRECT ANSWER

14. $\frac{E}{I \quad R}$ E = VOLTS
I = AMPS R = RESISTANCE

*ALL CORRECT ANSWERS ARE INDICATED IN BOLD TYPE

PRE-TEST FOR PHASE 2 HIGH TECH
GM SPECIFIC

Name:
Address:
Telephone #:
Years Tech. Training Experience___
Years Job Experience___
Type Of Work Presently Performing:

Employer:
Address:
Telephone #:
Immediate Boss:

Define the following abbreviations:

a. A.L.D.L.

b. E.C.M.

c. E.F.E.

d. E.F.I.

e. I.A.C.

f. M.A.F.

g. T.B.I.

h. M.A.T.

i. P.R.O.M.

j. T.P.S.

k. V.S.S.

(Circle the Correct Answer)

When a G.M. system goes into closed loop, besides the coolant sensor reaching an active temperature, what other sensor should be active?

a. M.A.F. b. Oxygen Sensor c. V.S.S.

To check if a coolant sensor is defective, which type of meter should you use?

a. Volt Meter b. Ohm Meter

At what variable voltage does a G.M. computer control system operate at?

a. 9 Volts b. 12 Volts c. 5 Volts

On a fuel injected engine, what sensor measures the amount of air entering the induction system?

On port fuel injected engines which are distributorless (besides an ignition module and an E.C.M.) what two sensors are used to acheive a controlled spark?

What is another name for a crankshaft sensor which was used in previous engine applications?

What proceedure should you use to determine if you have a weak or clogged fuel injector on a port fuel injected engine?

PRE EXAMEN PARA LA FASE 2 DE LA ALTA TECNOLOGIA

NOMBRE: DIRECCION: TELEFONO:

ANOS DE ENTRENAMIENTO TECNICO.

ANOS DE EXPERIENCIA EN TRABAJOS RELACIONADOS.

TIPO DE TRABAJO QUE HACE EL PRESENTE.

TALLER DONDE ESTA EMPLEADO:

DIRECCION: TELEFONO:

SUPERVISOR INMEDIATO:

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1. DEFINE LAS SIGUIENTES ABREVIATURAS

   a) A.L.D.L.
   b) E.C.M.
   c) E.F.E.
   d) E.F.I.
   e) I.A.C.
   f) M.A.F.
   g) T.B.I
   h) M.A.T.
   i) P.R.O.M.
   j) T.P.S.
   k) V.S.S.

ESCOGE LA CONTESTACION CORRECTA:

2. CUANDO UN CIRCUITO SE SIERRA EN EL SISTEMA DE LA GM, ADEMAS DEL "SENSOR" DE ENFRIAMIENTO ALCANZAR UNA TEMPERATURA ACTIVA, QUE OTRO "SENSOR" DEBE DE ACTIVARSE?

   a. M.A.F. b. "SENSOR" DE OXIGENO c. V.S.S.

3. PARA VERIFICAR SI EL "SENSOR" DE ENFRIAMIENTO ESTA DEFECTUOSO QUE TIPO DE METRO DEBE SER USADO?

   a. VOLTIMETRO b. METRO DE OHMIOS

4. A QUE CANTIDAD VARIABLE DE VOLTIOS OPERA EL SISTEMA DE CONTROL COMPUTADO DE LA GM?

   a. 9 VOLTIMETRO b. 12 VOLTIOS c. 5 VOLTIOS

5. EN UN MOTOR DE COMBUSTIBLE INYECTADO, QUE "SENSOR" MIDE LA CANTIDAD DE AIRE QUE ENTRA AL SISTEMA DE INDUCCION?

6. EN UN MOTOR CON UN PUERTO DE INYECCION DE COMBUSTIBLE EL CUAL NO TIENE DISTRIBUIDOR (ADEMAS DEL MODULO DEL INTERUPTOR DE PRENDER Y EL E.C.M.). CUALES OTROS DOS "SENSORES" SON USADOS PARA CONSEGUIR UNA CHISPA CONTROLADA.

7. CUAL ES EL OTRO NOMBRE PARA EL "SENSOR" DEL CIGUENAL, EL CUAL ERA ANTES USADO EN APLICACIONES DE MOTORES?

8. QUE PROCEDIMIENTO DEBE USTED USAR PARA DETERMINAR SI UN MOTOR CON UN PUERTO DE INYECTORES DE COMBUSTIBLE TIENE UNO DEBIL O TAPADO?

PROJECT CREATE

PHASE TWO
GM MANUFACTURER SPECIFIC
PRE- AND POST-TEST ANSWERS

1.

A) A.L.D.L. = ASSEMBLY LINE DIAGNOSTIC LINK
B) E.C.M. = ELECTRONIC CONTROL MODULE
C) E.F.E. = ELECTRONIC FUEL EVAPORATION
D) E.F.I. = ELECTRONIC FUEL INJECTION
E) I.A.C. = IDLE AIR CONTROL
F) M.A.F. = MASS AIR FLOW
G) T.B.I. = THROTTLE BODY INJECTION
H) M.A.T. = MANIFOLD AIR TEMPERATURE
I) P.R.O.M. = PROGRAMABLE READ OUT MEMORY
J) T.P.S. = THROTTLE POSITION SENSOR
K) V.S.S. = VEHICLE SPEED SENSOR

2. B) OXYGEN SENSOR

3. B) OHM METER

4. C) 5 VOLTS

6. CRANKSHAFT SENSOR AND CAMSHAFT SENSOR

7. HALL EFFECT SWITCH

8. INJECTION BALANCE TEST

AUTOMOTIVE CHAPTER TESTS
(PHASE ONE)

SPANISH

REVISION DE CAPITULO 1

Sumario

En este capitulo, examinamos el atomo y vimos que la orbita de valencia determina si el elemento sea conductor o aislador. El voltaje se defino como presion electrica; la corriente, medida por amperaje, se defino como electrones en mocion; y la resistencia, medida por ohmios, como la fuerza o oposicion al flujo de electrones. La interrelacion entre voltaje, amperaje, y resistencia se expreso en la formula llamada la ley de Ohm, mientras la cantidad de trabajo efectivo (definido como luz, calor, o campo magnetico) se expreso en la formula que calcula vatiaje. El uso de la ley de Ohm y de la formula de vatiaje estaban aplicados entonces a circuitos en serie, en paralelo, y en serie-paralelo. Ademas, discutimos el uso de mandos (interruptores o relevadores) y protectores de circuito (fusibles, disyuntores, o eslabones de fusible) para asegurar que el circuito funcione y que sea seguro de sobrecargas. Las cargas de tipo "designed-in" y de tipo falsas tambien fueron discutidas.

Escoge la contestacion correcta:

1. Cual de las siguientes no se necesita para un circuito cerrado?

   a. el fuente.
   b. los conductores.
   c. los controles.
   d. la carga.
   e. el relevador.

2. Anadir resistencia a un circuito de serie causara

   a. que fluja mas corriente.
   b. que fluja menos corriente.
   c. que baje la resistencia total.
   d. ninguna de las anteriores.

3. El voltaje

   a. fuerza la corriente al traves del circuito.
   b. resiste el flujo de corriente al traves del circuito.
   c. se mide en amperes.
   d. ninguna de las anteriores.

4. La corriente es

   a. electricidad que fluye al traves del circuito.
   b. resistencia en el circuito.
   c. caida de voltaje en el circuito.
   d. ambos b y c.

5. Un cortocircuito puede causar

   a. que se queme un fusible.
   b. que descargue la bateria.
   c. que se reviente el disyuntor.
   d. todas las anteriores.

6. Caida de voltaje es

   a. el voltaje usado para empujar la corriente al traves de una resistencia.
   b. la corriente usada para ir al traves de una resistencia.
   c. los electrones usados para ir al traves de una resistencia.
   d. ninguna de las anteriores.

7. La corriente se mide en

   a. ohmios.
   b. voltios.
   c. amperes.
   d. ninguna de las anteriores.

8. La resistencia se mide en

   a. voltios.
   b. amperes.
   c. ohmios.
   d. ninguna de las anteriores.

9. Un ejemplo de una carga es

   a. un motor.
   b. una bateria.
   c. un fusible.
   d. un diodo.

10. Cual de las siguientes es un ejemplo de un fuente de fuerza?

    a. una bateria.
    b. un arrangue.
    c. un generador electrico.
    d. a y c.

11. Cual de las siguientes es clasificada como protector de circuito?

    a. un fusible.
    b. un disyuntor.
    c. un eslabon de fusible.
    d. todas las anteriores.

CIERTO O FALSO

12. Un circuito cerrado es una senda completa para el flujo de electricidad empezando de un fuente y regresando al fuente.

13. La corriente fluira al traves de un circuito abierto.

14. La electricidad tiene mas que una senda para seguir en un circuito paralelo.

15. La resistencia total de todas las cargas paralelas siempre es menos que la resistencia individua mas pecuena.

16. Las resistencias de serie siemore acumulan.

17. Para averiguar la resistencia de un circuito, divide el amperaje por el voltaje: A/V.

18. La corriente en un circuito paralelo dividira entre las resistencias.

19. El voltaje dividira entre las resistencias dentro de un circuito de serie.

20. El amperaje total en un circuito paralelo sera las sumas de los circuitos individuos.

PAREE LA DEFINICION DE LA DERECHA CON LA PALABRA DE LA IZQUIERDA.

_____	21.	circuito de serie	a. presion electrica
_____	22.	circuito paralelo	b. resiste el flujo de electrones
_____	23.	conductor	c. una senda
_____	24.	insulador	d. unidad de resistencia
_____	25.	amperaje	e. pasa los electrones con facilidad
_____	26.	voltaje	f. usa baja corriente para controlar alta corriente
_____	27.	relevador	g. mas que una senda
_____	28.	resistencia	h. cantidad de electrones
_____	29.	ohmio	i. voltios por amperes
_____	30.	vatiaje	

REVISION DE CAPITULO 2

Escoge la contestacion correcta:

1. El mecanico A dice que medidores analogos estan sensibles a la polaridad. El mecanico B dice que no hay que poner los medidores digitales en cero antes de usarlos. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos.

2. El objeto del reglaje de alcance en un voltimetro es para

   a. asegurar que el medidor esta conectado correctamente para la polaridad.
   b. dar al medidor la abilidad de medir precisamente un alcance amplio de voltajes.
   c. proteger el medidor de sobrealcanzar el movimiento.
   d. todas las anteriores.

3. Un voltimetro esta siempre alambrado en _____ con la carga.

   a. paralelo.
   b. serie.
   c. serie o paralelo.
   d. ninguna de las anteriores.

4. Un amperimetro esta siempre alambrado en _____ con la carga.

   a. paralelo.
   b. serie.
   c. serie o paralelo.
   d. ninguna de las anteriores.

5. Una extension ("scope") podra medir el voltaje en

   a. un periodo de tiempo.
   b. un numero limitado de vehiculos.
   c. un alcance de la mayoria de los medidores digitales.
   d. unmedidor analogo.

6. El mecanico A dice que un medidor digital se prefiere al medidor analogo cuando se trabaja con circuitos sensibles de computadora. El mecanico B dice que un medidor analogo puede sobrecargar un circuito de computadora. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos.

7. Un amperimetro esta conectado directamente al positivo y al negativo de una bateria. Esto resultara en

   a. lecturas precisas.
   b. una indicacion del estado de la carga de la bateria.
   c. descargar la bateria.
   d. un medidor fundido normalmente.

8. Un ohmiometro esta conectado a un conductor y lee infinito. Esto indica

   a. nada.
   b. el alambre esta abierto.
   c. el alambre esta cortado.
   d. ninguna de las anteriores.

9. Una lectura de "0" ohmios indica

   a. mas resistencia esta presente que el medidor puede medir.
   b. que la bateria esta baja.
   c. que no hay resistencia entre los conductores del medidor.
   d. que se usa la extension erronea.

10. El mecanico A dice que la corriente maxima fluira al traves de "0" ohmios de resistencia. El mecanico B dice que infinito no permitira que fluya la corriente. Quien tiene razon?

    a. el mecanico A solamente.
    b. el mecanico B solamente.
    c. los dos mecanicos.
    d. ninguno de los dos.

CIERTO O FALSO

11. Ohmiometros analogos necesitan empezar de cero.

12. Voltimetros tienen su propio fuente de fuerza (normalmente una bateria interna).

13. Los medidores digitales reaccionan mas rapido que las extensiones oscilantes ("oscilloscopes").

14. Una lectura de infinito en un medidor digital normalmente se muestra como un numero seguido por blancos.

15. Los amperimetros de inductor tipo "pick-up" no pueden ser sobrealcanzados.

16. Los voltimetros normalmente estan sensibles a la polaridad.

17. Los amperimetros deben estar conectados a circuitos que ya tienen cargas resistivas.

18. Una lectura digital de 14.62 en la escala de 20.000 ohmios es efectivamente 1,462 ohmios.

19. Los voltimetros normalmente estan conectados al traves de la carga (en paralelo).

20. La corriente maxima fluye al traves de un circuito que mide infinito.

REVISION DE CAPITULO 4

Escoge la contestacion correcta:

1. Un metro de ohmios esta puesto al traves de un diodo y lee en ambos direcciones. El mecanico A dice que esto indica que el diodo obstruye la corriente en ambos direcciones. El mecanico B dice que esto indica que el diodo esta abierto y debe estar reemplazado. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos mecanicos.

2. Un diodo de "despiking"

   a. protege algunos de los circuitos en estado solido.
   b. no se puede probar con un metro de ohmios.
   c. no se usa en los vehiculos modernos.
   d. no se puede probar con una luz de prueba de auto poder.

3. Un "thermistor" de coeficiente negativo tendra su resistencia

   a. sube cuando aumenta la temperatura.
   b. queda igual cuando aumenta la temperatura.
   c. baja cuando aumenta la temperatura.
   d. baja cuando disminuye la temperatura.

4. Los "thermistors" se usan con frecuencia como

   a. unidades de "despiking".
   b. aparato de consumo de computadora.
   c. aparato de rendimiento de computadora.
   d. ninguna de las anteriores.

5. Los transistores ("NPN" o "PNP") tienen tres terminales identificados como

   a. anodo, catodo, circuito
   b. neutral, positivo, negativo.
   c. base, "emitter," colector.
   d. negativo, positivo, negativo o positivo, negativo, positivo.

6. Los transistores se usan con frecuencia como amplificadores y como

   a. diodos.
   b. interruptores.
   c. aisladores.
   d. conductores.

7. El termino estado solido indica que

   a. la corriente fluye al traves de un material solido.
   b. el aparato esta bien fabricada.
   c. el vacio tiene corriente que fluye al traves de ello.
   d. ninguna de las anteriores.

8. El mecanico A dice que puede ocurrir dano a un circuito de estado solido si el voltaje que carga aumenta demasiado. El mecanico B dice que puede ocurrir dano si el vehiculo anda con la bateria disconectada. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos.

9. Cuando el acelerador esta medio abierto el voltaje devuelto en un sistema de computadora de referencia de 5 voltios es 0.5 voltios. El mecanico A dice que esto es normal. El mecanico B dice que esto no es normal. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos.

10. El voltaje de bateria se da directamente al sensor de presion absoluta del multiple. El mecanico A dice que este procedimiento de prueba es incorrecto y puede destruir el "IC" dentro del sensor del "MAP." El mecanico B dice que este procedimiento no dara ninguna informacion valida. Quien tiene razon?

    a. el mecanico A solamente.
    b. el mecanico B solamente.
    c. los dos mecanicos.
    d. ninguno de los dos.

CIERTO O FALSO

11. Los diodos estan disenados con alta resistencia en una direccion y baja resistencia en la otra.

12. Cualquier metro de ohmios digital se puede probar diodos.

13. La prueba correcta de un "thermistor" exige una recitacion de resistencia y tambien una de temperatura.

14. "Thermistors" se usan con frecuencia como aparatos de entrada de computadora.

15. Los sensores de posicion del acelerador son resistores variables con dos alambres ligados.

16. El voltaje de referencia es la senal de voltaje que transmite la computadora.

17. El voltaje de referencia esta a menudc mas alto que el voltaje de bateria.

18. Un metro de ohmios se puede probar un sensor del "MAP."

19. Los sensores del "MAP" que se usan actualmente miden la presion en el multiple de admision.

20. Un transistor del "MAP" necesita que la bancada y el colector esten a potencial negativo para que la corriente salga el "emitter."

REVISION DE CAPITULO 5

Escoge la contestacion correcta:

1. El mecanico A dice que un punto comun esta representado por un punto negro en el diagrama de alambraje. El mecanico B dice que un conector puede ser un punto comun. Quien tiene razon?

   a. A solamente.
   b. B solamente.
   c. A y B.
   d. ninguno de los dos.

2. es el simbolo para un(a)

   a. punto comun.
   b. empalme.
   c. codigo de locacion.
   d. conector.

3. es el simbolo para un(a)

   a. conexion a tierra.
   b. conector.
   c. punto comun.
   d. ninguna de las anteriores.

4. El mecanico A dice que si un fusible se quema cuando se abre el interruptor, un circuito corto esta presente antes del interruptor. El mecanico B dice que el circuito corto esta completo cuando se cierra el interruptor. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos.

5. Una conexion a tierra remota es

   a. donde una conexion de tierra esta hecha en un punto que no sea el componente de la conexion de tierra.
   b. donde la tierra se completa por poner el componente en un envoltura de metal.
   c. donde se conectan dos o mas tierras.
   d. ninguna de las anteriores.

6. Una linea de puntos entre conectores indica que

   a. los conectores estan conectados electricamente.
   b. los conectores estan iguales fisicamente.
   c. el conector es un conector remoto.
   d. ninguna de las anteriores.

7. El mecanico A dice que dos conectores con el mismo numero son fisicamente el mismo conector. El mecanico B dice que los dos conectores se dibujan apartes para que el dibujo sea mas facil leer. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos.

8. Los codigos de locacion se dan en general para

   a. empalmes.
   b. conectores.
   c. componentes.
   d. todas de las anteriores.

9. Las tablas de circuito impreso se usan con frecuencia en

   a. montajes de tablero de instrumentos.
   b. interruptores de faro.
   c. circuitos de control para acondicionamiento del aire.
   d. todas de las anteriores.

10. Un interruptor se dibuja en un diagrama de alambraje con "NC" impreso a lo largo de ello. Esto indica que

   a. el interruptor estara cerrado normalmente cuando se anda el vehiculo.
   b. el interruptor estara abierto cuando no anda el vehiculo.
   c. el interruptor estara cerrado cuando no anda el vehiculo.
   d. ninguna de las anteriores.

CIERTO O FALSO

11. Un punto comun es un punto donde dos o mas alambres se conectan.

12. Un empalme nunca sera un punto comun.

13. "SPST" quiere decir solo polo. solo todo -- un estilo de interruptor.

14. Tocar una tabla de circuito impreso con las manos sucias puede rasgunar la superficie y hacerlo un circuito abierto.

15. Las lineas de punto entre el interruptor de las limpiaparabrisas indica que todas las limpiaparabrisas se mueven juntas.

16. Un codigo de locacion es un codigo que muestra la posicion de un componente en el diagrama de alambraje.

17. Una tierra de caja es un punto remoto donde dos o mas tierras se conectan.

18. Las tablas de circuito impreso se limpian con una goma buena.

19. Un resistor dibujado con una flecha al traves de ello es un simbolo para un "thermistor."

20. "W-BH" esta impreso en un alambre. Esto indica el color del alambre en el vehiculo.

REVISION DE CAPITULO 6

Escoge la contestacion correcta:

1. El mecanico A dice que una celula primaria se pueda recargar con un cargador de bateria. El mecanico B dice que una celula secundaria produce un voltaje mas alto que una celula primaria. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguna de las anteriores.

2. Seis celulas secundarias estan alambradas en paralelo. El mecanico A dice que su voltaje combinado es 2.1 voltios. El mecanico B dice que su capacidad de amperaje combinado es seis veces mas que lo de una celula singular. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguna de las anteriores.

3. Seis celulas secundarias estan alambrados en serie. El mecanico A dice que su voltaje combinado es 12.6 voltios. El mecanico B dice que su amperaje combinado es seis veces mas que lo de una celula singular. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguna de las anteriores.

4. Una bateria de acido de plomo cargada a maxima tiene placas hechas de

   a. dioxido de plomo y plomo esponjoso.
   b. dioxido de plomo y sulfato de plomo.
   c. plomo esponjoso y sulfato de plomo.
   d. celcio y antimonio.

5. El mecanico A dice que una bateria cargada a maxima no congelara tan facil como una muerta. El mecanico B dice que la gravedad especifica de una bateria muerta es alrededor de 1.100. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguna de las anteriores.

6. El proceso de electrolisis ocurre

   a. si la bateria se carga demasiado.
   b. si la bateria se carga despues de alcanzar la capacidad maxima.
   c. si el voltaje de carga sobrepasa 15 voltios.
   d. todas las anteriores.

7. Las placas positivas y negativas de una celula muerta son de

   a. calcio.
   b. plomo esponjoso.
   c. sulfate de plomo.
   d. dioxido de plomo.

8. Las recitaciones de gravedad especifica deben ser temperatura compensada porque

   a. ellas indican mejor el estado efectivo de la carga.
   b. el electrolito se engorda cuando se calienta mas que 80°.
   c. los hidrametros no funccionan con baterias frias.
   d. ninguna de las anteriores.

9. Una recitacion de gravedad especifica de 1.250 se obtiene con una temperatura de electrolito de 60°. El "SG" efectivo es

   a. 1.250.
   b. 1.258.
   c. 1.242.
   d. 1.230.

10. Las placas conductoras de una bateria de bajo mantenimiento usualmente son hechas de

   a. calcio.
   b. antimonio.
   c. cristal.
   d. dioxido de plomo.

CIERTO O FALSO

11. Una bateria de 50 amperios-horas es capable de tranamitir 10 amplos para 5 horas antes de morirse.

12. El tamano del motor usualmente determina el tamano de la bateria.

13. El voltaje del sistema cargador no debe sobrepasar 15 voltios para una bateria tibia (80°).

14. Las baterias de recombinacion de oxigano exigen agua frecuentamente.

15. Agua destilada o demineralizada es lo mejor anadir si una celula exige agua.

16. Un voltaje de circuito abierto en el alcance de 12.6 voltios indica una bateria sobre-cargada.

17. La eficiencia de la bateria se reduce cuando se baja la temperatura mas que 80°.

18. "A 350 cold cranking amp battery" se especifica como equipo original. Una bateria de repuesto debe ser 175 "CCA" como minimo.

19. Una bateria de una capacidad de reserva de 120 minutos puede transmitir 25 ampios para 12 horas antes de morirse.

20. Cuando se baja la temperatura exterior mas que 80°, la cantidad de corriente exigida para arrancar el motor tambien se baja.

REVISION DE CAPITULO 7

SUMARIO

En este capitulo, hemos visto los tipos mas comunes de probacion y servicio de la bateria del vehiculo. Para probar la bateria se necesita un hidrametro o una prueba de circuito abierto de voltaje para determinar el estado de la carga ("charge"), seguido por una prueba de cargamento ("load"), si la bateria estaba por lo menos 75% cargada. La prueba de carga de 3 minutos, como indicador del acumulador sulfatado, estaba trazada. Ademas, los procedimientos para limpiar los extremos de cable del borne de arriba y de lado se mostro. Reemplazar extremos de cable gastado o bien corroido se discutio junto con dar corriente ("jumpear") al vehiculo. El procedimiento correcto de cargar una bateria usando un voltimetro para observar la carga se mostro. El enfasis sobre seguridad durante todas las pruebas y servicios de bateria fue discutido.

Escoge la contestacion correcta:

1. El mecanico A dice que una recitacion de "OCV" de 12.6 voltios indica que una bateria hace falta recargar. El mecanico B dice que una recitacion de 1.265 hidrametros indica que una bateria hace falta recargar. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos.

2. Una bateria de 450 "CCA" se prueba para el ensayo de cargamento. El cargamento correcto es

   a. 1350 amperes.
   b. 450 amperes.
   c. 225 amperes.
   d. 990 amperes.

3. El mecanico A dice que durante un ensayo de cargamento, el voltaje de bateria no puede caer bajo 9.6 voltios. El mecanico B dice que el cargamento aplicado debe ser 3 veces la clasificacion del "A/H." Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos.

4. Las recitaciones del hidrametro estan entre 1.260 y 1.275. El mecanico A dice que un ensayo de cargamento determinara el resto de la informacion de la bateria. El mecanico B dice que un ensayo de cargamento no es necesario. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos.

5. Recitaciones del hidrametro de 1.200 a 1.220 estan tomados. El mecanico A recomienda un ensayo de cargamento, y luego hacer una prueba de carga de 3 minutos. El mecanico B recomienda recargar, luego hacer un ensayo de cargamento. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos.

6. La compensacion de temperatura se necesita un cambio de _____ en recitaciones; por cada 10°.

   a. 0.004.
   b. 0.040.
   c. 0.400.
   d. 4.000.

7. El mecanico A dice que una prueba de carga de 3 minutos ayuda identificar un acumulador sulfatado. El mecanico B dice que un acumulador sulfatado normalmente fracasara un ensayo de cargamento. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos.

8. Una prueba de carga de 3 minutos se hace en una bateria que ha fracasado un ensayo de cargamento. El mecanico A recomienda fijar el cargador a 40 amoios. El mecanico B dice que el voltaje debe quedarse bajo 15.5. Quien tiene razon?

   a. el mecanico A solamente.
   b. el mecanico B solamente.
   c. los dos mecanicos.
   d. ninguno de los dos.

9. La tapa de la bateria se limpia regularmente para

   a. estar linda.
   b. impedir sulfatacion.
   c. impedir descarga lenta al traves de la tapa.
   d. eliminar resistencia excesiva que aumentara el tiro del amperaje de arranque.

10. Los cables de la bateria negativa se quitan primero

   a. para ayudar impedir circuitos abiertos.
   b. solamente en las baterias de terminal lateral.
   c. para ayudar impedir circuitos cortos a tierra.
   d. todas las anteriores.

CIERTO O FALSO

11. Los cables de dar corriente se conectan primero a la bateria muerta del vehiculo cuando se va a dar corriente.

12. Un cargamento de 325 ampios por una bateria de 650 "CCA" es el ensayo de cargamento correcto.

13. 10.6 voltios durante un ensayo de cargamento indica que se necesita una bateria nueva.

14. Una prueba de carga de 3 minutos se usa en vez de un hidrametro para probar el estado de carga de la celula.

15. La necesidad de anadir agua a una bateria de bajo mantenimiento puede indicar un voltaje de carga mas alto que especificado.

16. Acido se anade a una bateria que tiene un nivel bajo de electrolito.

17. Una bateria cargada en seca se llena con agua para activarla.

18. Cargar rapido una bateria (mas alto que 15 voltios) aumentara su almacenaje.

19. Sulfatacion se aumenta si la bateria se deja en estado descargado por periodos extendidos de tiempo.

20. Cargar baterias puede emitir hidrogeno y oxigeno, que es explosivo.

AUTOMOTIVE CHAPTER TESTS
(PHASE ONE)

ANSWERS

PROJECT CREATE

PHASE ONE
ELECTRICITY & ELECTRONICS
CHAPTER TEST ANSWERS*

CHAPTER 1 TEST

Multiple Choice:

1.	A.	B.	C.	D.	**E.**
2.	A.	**B.**	C.	D.	
3.	**A.**	B.	C.	D.	
4.	**A.**	B.	C.	D.	
5.	A.	B.	C.	**D.**	
6.	**A.**	B.	C.	D.	
7.	A.	B.	**C.**	D.	
8.	A.	B.	**C.**	D.	
9.	**A.**	B.	C.	D.	
10.	**A.**	B.	C.	D.	
11.	A.	B.	C.	**D.**	

True or False:

12.	**T**	F
13.	T	**F**
14.	**T**	F
15.	**T**	F
16.	**T**	F
17.	T	**F**
18.	**T**	F
19.	**T**	F
20.	**T**	F

Match A thru I with 21 thru 30. Note: A thru I may be used more than once.

21.	**C**	22.	**G**
23.	**E**	24.	**B**
25.	**H**	26.	**A**
27.	**F**	28.	**B**
29.	**D**	30.	**I**

*ALL CORRECT ANSWERS ARE INDICATED IN BOLD TYPE

PROJECT CREATE

PHASE ONE
ELECTRICITY & ELECTRONICS
CHAPTER TEST ANSWERS*

CHAPTER 2 TEST

Multiple Choice:

1.	A.	B.	**C.**	D.
2.	A.	**B.**	C.	D.
3.	**A.**	B.	C.	D.
4.	A.	**B.**	C.	D.
5.	**A.**	B.	C.	D.
6.	A.	B.	**C.**	D.
7.	A.	B.	C.	**D.**
8.	A.	**B.**	C.	D.
9.	A.	B.	**C.**	D.
10.	A.	B.	**C.**	D.

True or False:

11.	**TRUE**	FALSE
12.	TRUE	**FALSE**
13.	TRUE	**FALSE**
14.	**TRUE**	FALSE
15.	TRUE	**FALSE**
16.	**TRUE**	FALSE
17.	**TRUE**	FALSE
18.	TRUE	**FALSE**
19.	**TRUE**	FALSE
20.	TRUE	**FALSE**

*ALL CORRECT ANSWERS ARE INDICATED IN BOLD TYPE

PROJECT CREATE

PHASE ONE
ELECTRICITY & ELECTRONICS
CHAPTER TEST ANSWERS*

CHAPTER 3 TEST

Multiple Choice:

1.	A.	**B.**	C.	D.
2.	A.	B.	**C.**	D.
3.	A.	B.	**C.**	D.
4.	**A.**	B.	C.	D.
5.	**A.**	B.	C.	D.
6.	A.	B.	**C.**	D.
7.	A.	B.	C.	**D.**
8.	A.	**B.**	C.	D.
9.	A.	B.	C.	**D.**
10.	A.	B.	**C.**	D.
11.	A.	**B.**	C.	D.
12.	**A.**	B.	C.	D.

True or False:

13.	**TRUE**	FALSE
14.	TRUE	**FALSE**
15.	**TRUE**	FALSE
16.	**TRUE**	FALSE
17.	TRUE	**FALSE**
18.	**TRUE**	FALSE
19.	**TRUE**	FALSE
20.	TRUE	**FALSE**

*ALL CORRECT ANSWERS ARE INDICATED IN BOLD TYPE

PROJECT CREATE

PHASE ONE
ELECTRICITY & ELECTRONICS
CHAPTER TEST ANSWERS*

CHAPTER 4 TEST

Multiple Choice:

1.	A.	B.	C.	**D.**
2.	**A.**	B.	C.	D.
3.	A.	B.	**C.**	D.
4.	A.	**B.**	C.	D.
5.	A.	B.	**C.**	D.
6.	A.	[illegible]	C.	D.
7.	**A.**	[illegible]	C.	D.
8.	A.	B.	**C.**	D.
9.	A.	**B.**	C.	D.
10.	A.	B.	**C.**	D.

True or False:

11.	**TRUE**	FALSE
12.	TRUE	**FALSE**
13.	**TRUE**	FALSE
14.	**TRUE**	FALSE
15.	TRUE	**FALSE**
16.	**TRUE**	FALSE
17.	TRUE	**FALSE**
18.	TRUE	**FALSE**
19.	**TRUE**	FALSE
20.	**TRUE**	FALSE

*ALL CORRECT ANSWERS ARE INDICATED IN BOLD TYPE

PROJECT CREATE

PHASE ONE
ELECTRICITY & ELECTRONICS
CHAPTER TEST ANSWERS*

CHAPTER 5 TEST

Multiple Choice:

1.	A.	B.	**C.**	D.
2.	A.	B.	C.	**D.**
3.	**A.**	B.	C.	D.
4.	A.	**B.**	C.	D.
5.	**A.**	B.	C.	D.
6.	A.	**B.**	C.	D.
7.	A.	B.	**C.**	D.
8.	A.	B.	C.	**D.**
9.	**A.**	B.	C.	D.
10.	A.	B.	**C.**	D.

True or False:

11.	**TRUE**	FALSE
12.	TRUE	**FALSE**
13.	**TRUE**	FALSE
14.	**TRUE**	FALSE
15.	**TRUE**	FALSE
16.	TRUE	**FALSE**
17.	TRUE	**FALSE**
18.	**TRUE**	FALSE
19.	TRUE	**FALSE**
20.	**TRUE**	FALSE

*ALL CORRECT ANSWERS ARE INDICATED IN BOLD TYPE

PROJECT CREATE

PHASE ONE
ELECTRICITY & ELECTRONICS
CHAPTER TEST ANSWERS*

CHAPTER 6 TEST

Multiple Choice:

1.	A.	**B.**	C.	D.
2.	A.	B.	**C.**	D.
3.	**A.**	B.	C.	D.
4.	**A.**	B.	C.	D.
5.	A.	B.	**C.**	D.
6.	A.	B.	C.	**D.**
7.	A.	B.	**C.**	D.
8.	**A.**	B.	C.	D.
9.	A.	B.	**C.**	D.
10.	**A.**	B.	C.	D.

True or False:

11.	**TRUE**	FALSE
12.	**TRUE**	FALSE
13.	**TRUE**	FALSE
14.	TRUE	**FALSE**
15.	**TRUE**	FALSE
16.	TRUE	**FALSE**
17.	**TRUE**	FALSE
18.	TRUE	**FALSE**
19.	TRUE	**FALSE**
20.	TRUE	**FALSE**

*ALL CORRECT ANSWERS ARE INDICATED IN BOLD TYPE

PROJECT CREATE

PHASE ONE
ELECTRICITY & ELECTRONICS
CHAPTER TEST ANSWERS*

CHAPTER 7 TEST

Multiple Choice:

1.	A.	B.	**C.**	D.
2.	A.	B.	**C.**	D.
3.	A.	B.	**C.**	D.
4.	**A.**	B.	C.	D.
5.	A.	**B.**	C.	D.
6.	**A.**	B.	C.	D.
7.	A.	B.	**C.**	D.
8.	A.	B.	**C.**	D.
9.	A.	B.	**C.**	D.
10.	A.	B.	**C.**	D.

True or False:

11.	TRUE	**FALSE**
12.	**TRUE**	FALSE
13.	TRUE	**FALSE**
14.	TRUE	**FALSE**
15.	**TRUE**	FALSE
16.	TRUE	**FALSE**
17.	TRUE	**FALSE**
18.	TRUE	**FALSE**
19.	**TRUE**	FALSE
20.	**TRUE**	FALSE

*ALL CORRECT ANSWERS ARE INDICATED IN BOLD TYPE

AUTOMOTIVE CHAPTER TESTS
(PHASE TWO)

PROJECT CREATE
GENERAL MOTORS SPECIFIC
TEST #1

NAME_____ DATE_____

(PLEASE CIRCLE THE CORRECT ANSWER)

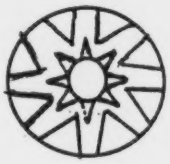
1. INSIDE AN H.E.I. DISTRIBUTOR, WHAT COMPONENT CONVERTS A SIGNAL FROM THE PICK-UP COIL?

A) TRANSDUCER *B) MODULE* *C) SWITCH*

2. WHEN TESTING A PICK-UP COIL, WHAT RANGE IS GOOD ON YOUR OHM METER?

A) 100 - 400 OHMS *B) 200 OHMS OR LOWER* *C) 500 - 1500 OHMS*

3. ON THE PICK-UP COIL SHOWN, HOW MANY CYLINDERS DOES THE ENGINE HAVE?



A) 6 CYLINDER *C) 4 CYLINDER*

B) 8 CYLINDER

4. IF AN ENGINE BUCKS OR CUTS OUT WHILE <u>ACCELERATING UNDER A LOAD</u>, WHAT COULD BE A POSSIBLE CAUSE?

A) WRONG PLUGS *B) LOW OCTANCE FUEL* *C) BROKEN WIRE TO PICK-UP COIL*

5. A TECHNICIAN REPLACES A DISTRIBUTOR COIL; WHEN STARTING, THE ENGINE STARTS HARD AND BACKFIRES. WHAT COULD BE THE CAUSE?

A) TERMINAL WIRES CROSSED *B) OPPOSITE MAGNETIC POLARITY*

C) CRACKED DISTRIBUTOR CAP

6. WHEN REPLACING A H.E.I. MODULE, WHAT SHOULD BE APPLIED TO THE BOTTOM?

A) GASKET *B) DI-ELECTRIC GREASE* *C) SILICONE*

(GM SPECIFIC/TEST 1 cont'd)

7. WHAT IS THE AIR/FUEL RATIO THE CARBURATOR SHOULD DELIVER TO THE ENGINE?

A) 13.8 - 1 *B) 14.7 - 1* *C) 14.0 OR GREATER*

8) WHAT COMPONENT WAS ADDED TO CARBURTORS TO METER FUEL FLOW?

A) COMPENSATOR VALVE *B) MIXURE CONTROL SOLONOID* *C) AIR CHECK VALVE*

9) WHAT COMPONENT TELLS THE E.C.M. HOW RICH THE ENGINE IS RUNNING?

A) O_2 SENSOR *B) CATALYTIC CONVERTER* *C) PRESSURE SENSOR*

10) WHAT ELECTRONIC PART IN THE E.C.M. HAS STORED DATA OF ALL THE INFORMATION OF THE VEHICLE?

PROJECT CREATE
GENERAL MOTORS SPECIFIC
OCT-DEC 1990
TEST #2

NAME: _____ **DATE** _____

* *

1. What material was added into the 3-way catalytic converter to help reduce Nitrogen Oxide?

2. If the P.R.O.M. is not fully seated, installed backwards, or is bad: what trouble code will appear in the E.C.M.?

3. Where in a vehicle equipped with a G.M. C.C.C. system is the coolant sensor located?

4. What two types of pressure sensors are used in the C.C.C. system?

5. At what temperature must a Oxygen Sensor reach before it will send a signal to the E.C.M. so that the E.C.M. can respond to it?

6. What does a Mixture Control Solenoid control in a C.C.C. carburetor?

7. What component controls the Mixture Control Solenoid?

(GM SPECIFIC/TEST 2 cont'd.)

8. (A) What voltage would be read on a voltmeter when checking a Throttle Position Sensor if the throttle is CLOSED?

ANSWER (A):

(B) What voltage would be read if the throttle is wide OPEN?

ANSWER (B):

9. Can the T.P.S. in a carburetor be adjusted?

10. If a speedometer has been disconnected, what Trouble Code would be stored in the E.C.M.?

PROJECT CREATE
GENERAL MOTORS SPECIFIC
TEST #4

NAME _____ **DATE** _____

(PLEASE CHECK THE CORRECT ANSWER)

1. This device is used to adjust idle speed in response to changing load conditions:
   a. ☐ throttle position sensor
   b. ☐ vehicle speed sensor
   c. ☐ idle air control valve
   d. ☐ fuel pressure regulator

2. The fuel pressure regulator assembly is part of the:
   a. ☐ fuel rail
   b. ☐ fuel pump
   c. ☐ fuel injector

3. The Idle Air Control Valve (IACV):
   a. ☐ provides additional air flow during cold starts
   b. ☐ adjusts engine speed during idle
   c. ☐ responds to a control signal from the ECM
   d. ☐ all of the above

4. A consistently low voltage output from the oxygen sensor (O_2) would indicate that the air/fuel mixture:
   a. ☐ is close to the ideal ratio of 14.7 to1
   b. ☐ is too lean
   c. ☐ is too rich

5. In mass air flow systems, air flow measurement is based on engine speed, memory data, and inputs from the:
   a. ☐ CTS and TPS sensors
   b. ☐ MAT and MAF sensors
   c. ☐ VSS and MAP sensors
   d. ☐ MAP and MAT sensors

6. The amount of fuel delivered to the engine is directly controlled by:
   a. ☐ fuel pump pressure
   b. ☐ manifold vacuum
   c. ☐ fuel injector on-time
   d. ☐ barometric pressure

7. In the 2.8 liter Gen II PFI system, the injectors are fired:
   a. ☐ sequentially, and once per cam revolution
   b. ☐ sequentially, and twice per cam revolution
   c. ☐ simultaneously, and twice per crankshaft revolution
   d. ☐ simultaneously, and once per crankshaft revolution

8. A consistently high voltage output from the oxygen sensor (O_2) would indicate that the air/fuel mixture:
   a. ☐ is close to the ideal ratio of 14.7 to 1
   b. ☐ is too lean
   c. ☐ is too rich

9. A high voltage output from the Manifold Absolute Pressure (MAP) sensor would indicate that:
   a. ☐ manifold absolute pressure is high
   b. ☐ manifold absolute pressure is low
   c. ☐ the engine is under maximum load
   d. ☐ both a. and c. are true
   e. ☐ both b. and c. are true

10. A low frequency (approx. 32 hertz) output from the mass air flow sensor indicates the engine is at:
   a. ☐ wide open throttle
   b. ☐ idle

11. A prolonged high voltage output from the O_2 sensor would cause the integrator value to:
   a. ☐ decrease, pulling fuel out of the mixture
   b. ☐ decrease, adding fuel to the mixture
   c. ☐ increase, adding fuel to the mixture
   d. ☐ remain at its no correction value of 128

12. Crankshaft sensor resistance should be:
    a. ☐ less than 1K ohms
    b. ☐ about 20 ohms
    c. ☐ between 900 and 1200 ohms
    d. ☐ greater than 15K ohms

13. The ECM controls coolant fan operation in response to:
    a. ☐ coolant temperatures
    b. ☐ manifold absolute pressure
    c. ☐ throttle position
    d. ☐ manifold air temperature
    e. ☐ all of the above

14. The fuel pump relay will not operate without:
    a. ☐ a high TPS signal
    b. ☐ a continous flow of reference pulses
    c. ☐ a VSS signal above 0 miles miles per hour
    d. ☐ a bypass signal from the DIS module

15. The ECM uses reference pulses to both initiate injector firing and to calculate:
    a. ☐ vehicle speed
    b. ☐ fuel pressure
    c. ☐ engine speed
    d. ☐ open loop/closed loop status

16. The ECM adjusts pulse width to control:
    a. ☐ fuel pressure
    b. ☐ vehicle speed
    c. ☐ fuel delivery
    d. ☐ fuel pump operation

17. One of the inputs used by the ECM to calculate engine load is supplied by:
    a. ☐ the mass air flow sensor
    b. ☐ the vehicle speed sensor
    c. ☐ the manifold absolute pressure sensor
    d. ☐ the throttle position sensor

18. A high TPS output voltage (approx. 4.5 volts) during engine cranking would cause the ECM to:

a. ☐ enable the clear flood mode
b. ☐ increase injector pulse width
c. ☐ reset block learn memory
d. ☐ set a trouble code 22

19. For a given rpm/load range, a block learn memory value of 145 would indicate that:

a. ☐ the air/fuel mixture is rich
b. ☐ the air/fuel mixture is about right
c. ☐ the air/fuel mixture is lean

20. One of the three (3) requirements that must be met before the PFI system switches to closed loop operation:

a. ☐ vehicle speed is greater than 0 mph
b. ☐ a specified amount of time has elsaped since starting the engine
c. ☐ TPS output exceeds 3.25 volts
d. ☐ fuel pressure reaches approximately 10 psi.

PROJECT CREATE
GM SPECIFIC
TEST#3

NAME_____ DATE_____

1. The amount of fuel delivered to the engine is directly controlled by:
   a. ☐ fuel pump pressure
   b. ☐ manifold vacuum
   c. ☐ fuel injector on-time
   d. ☐ barometric pressure

2. The Throttle Body Back-up (TBB) circuit, programmed to take over responsibility for fuel delivery in the event of an ECM failure, is located in the:
   a. ☐ throttle body
   b. ☐ distributor
   c. ☐ HEI module
   d. ☐ Electronic Control Module (ECM)

3. The fuel meter assembly is part of the:
   a. ☐ Throttle Body Injection (TBI) unit
   b. ☐ fuel pump
   c. ☐ intake manifold
   d. ☐ fuel injector

4. The Idle Air Control Valve (IACV):
   a. ☐ provides additional air flow during cold starts
   b. ☐ adjusts engine speed during idle
   c. ☐ responds to a control signal from the ECM
   d. ☐ all of the above

5. A low voltage output from the oxygen sensor (O_2) would indicate that the air/fuel mixture:
   a. ☐ is close to the ideal ratio of 14.7 to 1
   b. ☐ is too lean
   c. ☐ is too rich

6. A high voltage output from the Manifold Absolute Pressure (MAP) sensor would indicate that:

a. ☐ manifold absolute pressure is high
b. ☐ manifold absolute pressure is low
c. ☐ the engine is under maximum load
d. ☐ both a. and c. are true
e. ☐ both b. and c. are true

7. The ECM controls torque converter lock-up are based on a signal from the:

a. ☐ TPS
b. ☐ gear selector lever
c. ☐ vehicle speed sensor (VSS)
d. ☐ coolant temperature sensor (CTS)

8. In the event of a fuel pump relay failure, fuel pump voltage would be supplied through this backup circuit:

a. ☐ park/neutral switch
b. ☐ oil pressure switch
c. ☐ voltage regulator
d. ☐ coolant temperature sensor

9. The in-tank fuel pump will not operate without:

a. ☐ continuous distributor reference pulses
b. ☐ a high TPS signal
c. ☐ a VSS signal above 0 miles per hour
d. ☐ a bypass signal from the HEI module

10. The optimum air/fuel ratio for best catalytic converter efficiency is:

a. ☐ 20 to 1
b. ☐ 7.4 to 1
c. ☐ 10 to 1
d. ☐ 14.7 to 1

11. The fuel pressure regulator maintains system pressure at approximately:

a. ☐ 20 psi
b. ☐ 10 psi
c. ☐ 5 psi
d. ☐ 32 psi

12. The ECM uses distributor reference pulses to both initiate injector firing and to calculate:

a. ☐ vehicle speed
b. ☐ fuel pressure
c. ☐ engine rpm
d. ☐ open loop/closed loop status

13. The ECM adjusts pulse width to control:

a. ☐ fuel pressure
b. ☐ vehicle speed
c. ☐ fuel delivery
d. ☐ fuel pump operation

14. In the synchronous pulse mode, the fuel injector is energized:

a. ☐ once every second
b. ☐ twice every second
c. ☐ once for every distributor reference pulse
d. ☐ once each crankshaft revolution

15. The asynchronous pulse mode is active during:

a. ☐ acceleration enrichment
b. ☐ cold starting
c. ☐ open loop mode
d. ☐ idle

16. The ECM adjusts the cranking air/fuel ratio based on the input from this sensor:

a. ☐ throttle position sensor (TPS)
b. ☐ manifold absolute pressure sensor (MAP)
c. ☐ oxygen sensor (O_2)
d. ☐ coolant temperature sensor (CTS)

17. Clear flood mode is active whenever engine rpm is below the RUN threshold, and the:

a. ☐ TPS signal is greater than 3.25 volts
b. ☐ MAP signal is greater than 3.25 volts
c. ☐ TPS signal is below 3.25 volts
d. ☐ CTS signal indicates a cold engine

18. In open loop run mode, the ECM calculates the air/fuel ratio based on inputs from the coolant temperature sensor (CTS) and:
   a. ☐ throttle ;position sensor (TPS)
   b. ☐ idle air control valve (IACV)
   c. ☐ vehicle speed sensor (VSS)
   d. ☐ manifold absolute pressure sensor (MAP)

19. In open loop run mode, the air/fuel ration is:
   a. ☐ fixed at 14.7 to 1
   b. ☐ adjusted according to the O_2 sensor voltage
   c. ☐ selected from the ECM's memory
   d. ☐ a very rich mixture

20. One of the three (3) requirements that must be met before the EFI system switches to closed loop operation:
   a. ☐ vehicle speed is greater than 0 mph
   b. ☐ a specified amount of time has elapsed since starting the engine
   c. ☐ TPS output exceeds 3.25 volts
   d. ☐ fuel system pressure reaches approximately 10 psi

21. In closed loop operation, the ECM adjusts fuel delivery based on a signal from the:
   a. ☐ O_2 sensor
   b. ☐ throttle position sensor (TPS)
   c. ☐ manifold absolute pressure (MAP) sensor
   d. ☐ coolant temperature sensor (CTS)

22. The ECM enriches the air/fuel mixture during acceleration by:
   a. ☐ increasing the fuel pump pressure
   b. ☐ pulsing the injector twice for each distributor
   c. ☐ adding asynchronous fuel pulses
   d. ☐ reducing the volume of air mixed with the fuel

23. During deceleration mode, the ECM:
   a. ☐ increases the injector pulse width
   b. ☐ generates asynchronous injector pulses
   c. ☐ selects a richer air/fuel mixture
   d. ☐ pulses the injector for 0.5 milliseconds or less

24. The HEI distributor contains:
    a. ☐ the ignition coil and HEI module
    b. ☐ both the pick-up coil and ignition coil
    c. ☐ the HEI module and advance weights
    d. ☐ the pick-up coil and HEI module

25. This device generates the reference pulses used to calculate engine rpm and to initiate injector pulses:
    a. ☐ the pick-up coil
    b. ☐ the HEI module
    c. ☐ the vehicle speed sensor (VSS)
    d. ☐ the ECM

26. The two spark timing modes used in the HEI system are:
    a. ☐ direct and bypass
    b. ☐ bypass and EST
    c. ☐ EST and direct
    d. ☐ HEI and EST

27. High voltage (approx. 4 volts) on the HEI module bypass line transfers control of spark timing to:
    a. ☐ the HEI module
    b. ☐ the distributor
    c. ☐ the ECM
    d. ☐ the vacuum advance unit

28. The ALCL/ALDL connector:
    a. ☐ is located under the dash
    b. ☐ connects to the ECM
    c. ☐ is designed to be used with a scan tool
    d. ☐ all of the above

29. The diagnostic circuit check is performed by jumpering these pins on the ALCL/ALDL connector:
    a. ☐ A and B
    b. ☐ B and C
    c. ☐ A and C
    d. ☐ A and F

30. To switch from the diagnostic circuit check to the field service mode:

a. ☐ move the jumper to ALCL pins A and F
b. ☐ remove the jumper and start the engine
c. ☐ start the engine with a jumper between ALCL pins A & F
d. ☐ start the engine with a jumper between ALCL pins A & B

PROJECT CREATE
GENERAL MOTORS SPECIFIC
TEST #5

NAME _____ **DATE** _____

(PLEASE CHECK THE CORRECT ANSWER)

1. Spark plug wires should be replaced:
   a. ☐ if their resistance does not meet specifications
   b. ☐ if they are visibly cut, burned or damaged
   c. ☐ if they induce a voltage in the wire
   d. ☐ both A and B

2. When troubleshooting a driveability condition, you should first:
   a. ☐ determine if the problem is in the fuel or the ignition system
   b. ☐ make a careful visual inspection
   c. ☐ replace the ECM
   d. ☐ both A and B

3. A spark plug tester will spark if:
   a. ☐ any voltage is present
   b. ☐ a high enough voltage is present
   c. ☐ the ignition wires are defective
   d. ☐ if resistance is present

4. If the spark plug wires are defective:
   a. ☐ a no-start condition could result
   b. ☐ a driveability condition could result
   c. ☐ sufficient voltage may not be available to the spark plugs
   d. ☐ all of the above

5. To determine if a port fuel injection engine is receiving enough fuel:
   a. ☐ use a test light to determine if the injectors are receiving electrical pulses
   b. ☐ check the fuel system pressure with a gauge
   c. ☐ look inside the carburetors while the engine is being cranked
   d. ☐ both A and B

6. A car cranks very slowly and will not start. The problem most likely is in the:

a. ☐ ECM
b. ☐ fuel system
c. ☐ starting and changing systems
d. ☐ none of the above

7. The primary coil resistance should be checked with:

a. ☐ a voltmeter
b. ☐ an ammeter
c. ☐ an ohmmeter
d. ☐ none of the above

8. Spark plugs should be checked to see:

a. ☐ if the gap is correct
b. ☐ if they are burned or fouled
c. ☐ if they are the proper type and heat range
d. ☐ all of the above

9. With the engine cranking and coils removed, the DIS Ignition module can be checked with:

a. ☐ an ohmmeter
b. ☐ a 12-volt test light
c. ☐ a very bright flashlight
d. ☐ none of the above

10. The condition of the battery:

a. ☐ is not important when diagnosing an ignition problem
b. ☐ is only important on six-volt ignition systems
c. ☐ should be checked while troubleshooting an ignition system problem
d. ☐ should only be checked if the car is out of gas

11. Manufacturers' service manuals:
    a. ☐ are a good source for troubleshooting information
    b. ☐ should be consulted for proper specificiations
    c. ☐ both, B and C
    d. ☐ can only be used on breaker point systems

12. A spark tester is used to:
    a. ☐ check the ignition coil output
    b. ☐ see if the engine is receiving a proper air-fuel mixture
    c. ☐ determine if the battery is fully charged
    d. ☐ check the condition of the spark plugs

13. An engine that cranks but will not start could have:
    a. ☐ no fuel delivery
    b. ☐ a defective ignition module
    c. ☐ either A and B
    d. ☐ neither A nor B

14. The magnetic crankshaft sensor can be checked with:
    a. ☐ a voltmeter using an AC scale
    b. ☐ an ohmmeter
    c. ☐ both, A and B
    d. ☐ a test light

15. The ignition coil's secondary resistance should be checked with:
    a. ☐ an ohmmeter
    b. ☐ an ammeter
    c. ☐ both, A and B
    d. ☐ a high quality test light

PROJECT CREATE
GENERAL MOTORS SPECIFIC
TEST #6

NAME _____ **DATE** _____

(PLEASE CHECK THE CORRECT ANSWER)

1. The magnetic crankshaft sensor consists of:
   a. ☐ a coil of wire
   b. ☐ a magnet
   c. ☐ a small set of breaker points
   d. ☐ both, A and B

2. The magnetic crankshaft sensor:
   a. ☐ sends high voltage directly to the spark plugs
   b. ☐ sends low voltage pulses to the ignition module
   c. ☐ is found only on cars more than fifty years old
   d. ☐ is mounted inside the distributor

3. The Hall Effect:
   a. ☐ uses the interaction of magnetic and electrical forces to make a signal
   b. ☐ is used with a magnetic crankshaft sensor
   c. ☐ is used for reference pulses on the C$_3$I system
   d. ☐ both, and A and C

4. The C$_3$I system uses:
   a. ☐ a reluctor and pickup coil
   b. ☐ a Hall Effect switch
   c. ☐ a modernized point system
   d. ☐ both, A and C

5. The breaker-point ignition system uses:
   a. ☐ seven cylinders
   b. ☐ four cylinders
   c. ☐ six cylinders
   d. ☐ both, B or C

6. The crankshaft reluctor wheel:
   a. ☐ is cast into the crankshaft
   b. ☐ has six evenly spaced notches cut into it
   c. ☐ has a seventh notch offset by ten degrees
   d. ☐ all of the above

7. Integrated Direction Ignition (IDI):
   a. ☐ has no spark plug wires
   b. ☐ uses a magnetic crankshaft sensor
   c. ☐ mounts the distributor between the camshaft covers
   d. ☐ both, A and B

8. The six cylinder DIS Ignition module fires a coil:
   a. ☐ after every notch of the crankshaft reluctor
   b. ☐ after every other notch of the crankshaft reluctor
   c. ☐ independently of the notches
   d. ☐ none of the above

9. The Hall Effect switch found on C₃I engines is found:
   a. ☐ directly attatched to the distributor
   b. ☐ on the front of the engine
   c. ☐ behind the harmonic balancer
   d. ☐ both, B and C

10. The magnetic crankshaft sensor on a DIS is most like which component on an engine equipped with a distributor?
   a. ☐ the rotor
   b. ☐ the pickup coil
   c. ☐ the ignition module
   d. ☐ the distributor cap

PROJECT CREATE
GENERAL MOTORS SPECIFIC
TEST #7

NAME _____ **DATE** _____

(PLEASE CHECK THE CORRECT ANSWER)

1. To generate high voltage, DIS systems use:
   a. ☐ a standard ignition coil
   b. ☐ one ignition coil for every two cylinders
   c. ☐ no ignition coil
   d. ☐ one coil that sparks very rapidly

2. Electricity:
   a. ☐ has a positive polarity
   b. ☐ has no polarity
   c. ☐ has a negative polarity
   d. ☐ both, A and C

3. DIS systems were designed to:
   a. ☐ reduce the amount of fuel consumed
   b. ☐ reduce the number of components involved in routine ignition maintenance
   c. ☐ provide higher secondary voltages
   d. ☐ both, C and D

4. A six-cylinder engine equipped with DIS uses how many coils?
   a. ☐ one
   b. ☐ two
   c. ☐ three
   d. ☐ six

5. Voltage is:
   a. ☐ electrical flow
   b. ☐ electrical pressure
   c. ☐ another word for magnetic field
   d. ☐ electrical resistance

6. The DIS system fires the spark plug on the:
   a. ☐ intake stroke
   b. ☐ exhaust stroke
   c. ☐ compression stroke
   d. ☐ both, B and C

7. The ignition system using waste spark:
   a. ☐ has fewer moving parts than engines
   b. ☐ can deliver higher voltage
   c. ☐ requires less maintenance
   d. ☐ all of the above

8. In the DIS Ignition system the spark plugs:
   a. ☐ both fire negatively
   b. ☐ both fire positively
   c. ☐ fire in opposite polarities
   d. ☐ none of the above

9. The ignition colls in DIS are:
   a. ☐ connected to the ignition module by a short wire
   b. ☐ mounted directly to the ignition module
   c. ☐ mounted inside the passenger compartment
   d. ☐ found inside the distributor

10. "Waste Spark" means:
   a. ☐ two spark plugs fire at the same time but only one ignites the air-fuel mixture
   b. ☐ one spark plug is always firing and the other is kept in reserve for extra power
   c. ☐ neither A nor B
   d. ☐ either A or B

11. Electrical current is caused by:
   a. ☐ the movement of positive and negative forces in a circuit
   b. ☐ a rapid change in temperature
   c. ☐ a loss of voltage
   d. ☐ all of the above

12. DIS systems fire the plugs:
    a. ☐ near Top Dead Center (TDC)
    b. ☐ near Bottom Dead Center (BDC)
    c. ☐ both, A and B
    d. ☐ neither A nor B

13. In DIS, each coil fires its two spark plugs:
    a. ☐ at 180 degrees from each other
    b. ☐ always at the same time
    c. ☐ at different times, depending on engine conditions
    d. ☐ whenever the rotor is lined up with the proper spark plug wire

14. In a DIS system:
    a. ☐ the primary and secondary windings are connected
    b. ☐ the primary and secondary windings are not connected
    c. ☐ two spark plugs are fired at the same time
    d. ☐ both, B and C

15 The waste spark occurs on the:
    a. ☐ intake stroke
    b. ☐ compression stroke
    c. ☐ power stroke
    d. ☐ exhaust stroke

PROJECT CREATE
GENERAL MOTORS SPECIFIC
TEST #8

NAME _____ **DATE** _____

(PLEASE CHECK THE CORRECT ANSWER)

21. An integrator value of 113 would indicate that:
    a. ☐ the ECM is commanding a leaner mixture
    b. ☐ the open loop air/fuel ratio is rich
    c. ☐ the ECM is commanding a rich mixture
    d. ☐ the ECM is increasing pulse width

22. The direct ignition system (DIS) secondary coil resistance should measure:
    a. ☐ greater than 10K ohms
    b. ☐ less than 1K ohms
    c. ☐ between 12K and 15K ohms
    d. ☐ between 5K and 7K ohms

23. This device generates the reference pulses used to calculate engine rpm and to initiate injector firing:
    a. ☐ the crankshaft sensor
    b. ☐ the HEI coil
    c. ☐ the vehicle speed sensor (VSS)
    d. ☐ the ECM

24. The two spark timing modes used in the DIS system are:
    a. ☐ direct and bypass
    b. ☐ bypass and EST
    c. ☐ EST and direct
    d. ☐ HEI and EST

25. High voltage (approx. 4 volts) on the DIS module's bypass line transfers control of spark timing to:
    a. ☐ the DIS module
    b. ☐ the ignition coil assembly
    c. ☐ the ECM
    d. ☐ the vacuum advance unit

26. Which of the following would not result in a failure to hold fuel pressure after the fuel pump is shut off:

a. ☐ a leaky pulsator
b. ☐ a stuck open injector
c. ☐ a disconnected vacuum hose on the pressure regulator assembly
d. ☐ a defective check valve in the fuel pump

27. The diagnostic circuit check is performed by jumpering these pins on the ALDL connector:

a. ☐ A and B
b. ☐ B and C
c. ☐ A and C
d. ☐ A and F

28. To switch from the diagnostic mode to the field service mode:

a. ☐ move the jumper to ALDL pins A and F
b. ☐ remove the jumper and start the engine
c. ☐ start the engine and jumper between ALDL pins A and F
d. ☐ start the engine and jumper between ALDL pins A and B

29. During cranking, the ECM calculates IACV pintle position based on:

a. ☐ coolant temperature
b. ☐ throttle position
c. ☐ rpm
d. ☐ mass air flow

30. The ECM resumes control of idle speed when:

a. ☐ TPS output exceeds 4 volts
b. ☐ both, TPS and MAP output exceed 4 volts
c. ☐ TPS output rises, and VSS is above set limit
d. ☐ TPS output drops, and VSS is below set limit

31. Extending the IACV pintle towards its seat would:

a. ☐ decrease bypass air flow, and increase rpm
b. ☐ increase bypass air flow, and increase rpm
c. ☐ decrease bypass air flow, and decrease rpm
d. ☐ increase bypass air flow, and decrease rpm

32. If the ECM detects low O_2 sensor voltage, it will:
    a. ☐ decrease injector pulse width to add fuel
    b. ☐ increase injector pulse width to remove fuel
    c. ☐ reduce air flow
    d. ☐ increase injector pulse width to add fuel

33. In open loop operation, pulse width is calculated from memory data, engine load, and:
    a. ☐ both, engine speed and coolant temperature
    b. ☐ both, engine speed and vehicle speed
    c. ☐ throttle position
    d. ☐ coolant temperature

34. An IACV reset is enabled when the ECM detects:
    a. ☐ an ignition off to ignition on transition
    b. ☐ an engine running to ignition off transition
    c. ☐ an IACV count above 150
    d. ☐ a low idle speed

35. With key on/engine off, a technician measures about 5 volts DC when backprobing the knock sensor circuit at the ECM. Which of the following would not be a valid conclusion?
    a. ☐ broken wire in knock sensor line
    b. ☐ poor mating between knock sensor and its harness connector
    c. ☐ knock sensor signal line is shorted to ground

36. When terminal F in the ALDL connector is grounded:
    a. ☐ the service engine soon lamp will flash
    b. ☐ the in-tank fuel pump is energized
    c. ☐ the diverter valve is energized
    d. ☐ the TCC solenoid is energized

37. With the engine running, fuel pressure should measure between:
    a. ☐ 234 kPa and 325 kPa
    b. ☐ 200 kPa and 255 kPa
    c. ☐ 280 kPa and 325 kPa

38. A technician has made two fuel pressure measurements, one with key on/engine off, and the other with the engine running. Which statement is correct?

a. ☐ both readings are the same
b. ☐ pressure is lower with key on/engine off
c. ☐ pressure is higher with the engine running
d. ☐ pressure is higher with key on/engine off

39. Resistance between the ECM's quad driver outputs and ground should measure:

a. ☐ less than 10K ohms
b. ☐ greater than 50K ohms
c. ☐ greater than 1 meg-ohm
d. ☐ less than 50K ohms

40. A technician measures about 5 volts on the Bypass line to the DIS Module. Which two statements are correct?

a. ☐ spark advance is under ECM control
b. ☐ spark advance is fixed to the DIS module
c. ☐ engine speed is above 400 rpm
d. ☐ engine speed is below 400 rpm

AUTOMOTIVE CHAPTER TESTS
(PHASE TWO)

ANSWERS

PROJECT CREATE
GENERAL MOTORS SPECIFIC
ANSWER SHEET
TEST #1

1. B) MODULE
2. C) 500 - 1500 OHMS
3. B) 8 CYLINDER
4. C) BROKEN WIRE TO PICK-UP COIL
5. B) OPPOSITE MAGNETIC POLARITY
6. B) DI-ELECTRIC GREASE
7. B) 14.7 - 1
8. B) MIXTURE CONTROL SOLONOID
9. A) O_2 SENSOR
10. P.R.O.M. (PROGRAM READ ONLY MEMEORY)

PROJECT CREATE
GENERAL MOTORS SPECIFIC
ANSWER SHEET
TEST #2

1. RHODIUM
2. CODE 51
3. WATER JACKET
4. ABSOLUTE AND DIFFERENTIAL
5. 315 DEGREES CENTIGRADE / 600 DEGREES FAHRENHEIT
6. FUEL FLOW
7. E.C.M. (ELECTRONIC CONTROL MODULE)
8. 1 VOLT OR LESS
9. YES
10. CODE 24

PROJECT CREATE
GENERAL MOTORS SPECIFIC
ANSWER SHEET
TEST #3

1. C) FUEL INJECTOR ON-TIME
2. D) ELECTRONIC CONTROL MODULE (ECM)
3. A) THROTTLE BODY INJECTION (TBI)
4. D) ALL OF THE ABOVE
5. B) IS TOO LEAN
6. D) BOTH A AND C ARE TRUE
7. C) VEHICLE SPEED SENSOR (VSS)
8. B) OIL PRESSURE SWITCH
9. A) CONTINOUS DISTRIBUTOR REFERENCE PULSES
10. D) 14.7 to 1
11. B) 10 psi
12. C) ENGINE RPM
13. C) FUEL DELIVERY
14. C) ONCE FOR EVERY DISTRIBUTOR REFERENCE PULSE
15. A) ACCELERATION ENRICHMENT
16. D) COOLANT TEMPERATURE SENSOR (CTS)
17. TPS SIGNAL IS GREATER THAN 3.25 VOLTS

GM TEST #3 ANSWERS Cont'd

18. D) MANIFOLD ABSOLUTE TEMPERATURE SENSOR (MAP)

19. C) SELECTED FROM THE ECMs MEMORY

20. B) A SPECIFIED AMOUNT OF TIME HAS ELAPSED SINCE STARTING THE ENGINE

21. A) O_2 SENSOR

22. C) ADDING ASYNCHRONOUS FUEL PULSES

23. B) GENERATES ASYNCHRONOUS INJECTOR PULSES

24. D) THE PICK-UP COIL AND HEI MODULE

25. A) THE PICK-UP COIL

26. B) BYPASS AND EST

27. C) THE ECM

28. D) ALL OF THE ABOVE

29. A) A AND B

30. D) START THE ENGINE WITH A JUMPER BETWEEN ALCL PINS A & B

PROJECT CREATE
GENERAL MOTORS SPECIFIC
ANSWER SHEET
TEST #4

1. C) idle air control valve
2. A) fuel rail
3. D) all of the above
4. B) is too lean
5. B) MAT and MAF sensors
6. C) fuel injector on-time
7. D) simultaneously, once per crankshaft revolution
8. c) is too rich
9. D) both, a and c are true
10. B) idle
11. A) decrease, pulling fuel out of the mixture
12. C) between 900 and 1200 ohms
13. A) coolant temperatures
14. B) a continous flow of reference pulses
15. C) engine speed
16. C) fuel delivery
17. A) the mass air flow sensor
18. A) enable the clear flood mode
19. C) the air/fuel mixture is lean
20. B) a specified amount of time has elapsed since starting engine

PROJECT CREATE
GENERAL MOTORS SPECIFIC
ANSWER SHEET
TEST #5

1. D) both A and B
2. D) both A and B
3. B) a high enough voltage is present
4. D) all of the above
5. D) both A and B
6. C) starting and changing systems
7. C) an ohmmeter
8. D) all of the above
9. B) a 12-volt test light
10. C) checked while troubleshooting an ignition system problem
11. C) both A and B
12. A) check the ignition coil output
13. C) either A and B
14. B) an ohmmeter
15. A) an ohmmeter

PROJECT CREATE
GENERAL MOTORS SPECIFIC
ANSWER SHEET
TEST #6

1. D) both A and B
2. B) sends low voltage pulses to the ignition module
3. D) both A and C
4. B) a Hall Effect switch
5. D) both B or C
6. D) all of the above
7. D) both A and B
8. A) after every notch of the crankshaft reluctor
9. D) both B and C
10. B) the pick-up coil

PROJECT CREATE
GENERAL MOTORS SPECIFIC
ANSWER SHEET
TEST #7

1. B) one ignition coil for every two cylinders
2. D) both A and C
3. D) both C and D
4. C) three
5. B) electrical pressure
6. D) both B and C
7. D) all of the above
8. C) fire in opposite polarities
9. B) mounted directly to the ignition module
10. A) two spark plugs fire at the same time but only one ignites the air-fuel mixture
11. A) the movement of positive and negative forces in a circuit
12. A) near Top Dead Center (TDC)
13. B) always at the same time
14. D) both B and C
15. D) exhaust stroke

PROJECT CREATE
GENERAL MOTORS SPECIFIC
ANSWER SHEET
TEST #8

21. A) the ECM is commanding a leaner mixture

22. D) between 5K and 7K ohms

23. A) the crankshaft sensor

24. B) bypass and EST

25. C) the ECM

26. C) a disconnected vacuum hose on the pressure regulator assembly

27. A) A and B

28. D) start the engine and jumper between ALDL pins A and B

29. A) coolant temperature

30. D) TPS output drops, and VSS is below set limit

31. C) decrease bypass air flow, and decrease rpm

32. D) increase injector pulse width to add fuel

33. A) both, engine speed and coolant temperature

34. B) an engine running to ignition off transition

35. C) knock sensor signal line is shorted to ground

36. D) the TCC solenoid is energized

37. A) 234 kPa and 325 kPa

GM TEST #8 ANSWERS Cont'd.

38. D) pressure is higher with key on/engine off

39. B) greater than 50K ohms

40. A) spark advance is under ECM control
    C) engine speed is above 400 rpm

COORDINATED TRAINING AGREEMENT

METALWORKING

COORDINATED METALWORKING TRAINING MEMORANDUM OF AGREEMENT

* * * * * * * * * * *

MAY 16, 1988

Signing Organizations and Agencies:

Hampden County Employment and Training Consortium

Machine Action Project

Massachusetts Career Development Institute

Massachusetts Department of Education, Western Massachusetts Regional Education Center

Massachusetts Department of Employment and Training

Massachusetts Department of Labor and Industries, Division of Apprentice Training

Pioneer Valley Central Labor Council

Springfield Action Commission

Springfield Technical Community College

National Tooling and Machining Association, Western Mass. chapter

United States Department of Labor, Bureau of Apprenticeship and Training

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COORDINATED METALWORKING TRAINING
MEMORANDUM OF AGREEMENT
MAY 16, 1988

There is a serious shortage of skilled workers needed to fill job openings in Hampden County. An April 1988 report prepared for the Private Industry Council by Paul Simpson and Robert Vinson of the Massachusetts Division of Employment Security states that "the tight labor market that exists presently is not a temporary phenomenon, but a situation anticipated to continue into the 1990's." The report concludes that any solutions to this problem will only be found in the cooperation of public policymakers, educators, business leaders, the employment and training system, and the region's human services network.

The coordinated effort to provide training in the field of machining, outlined herein, represents such a collaboration.

Today, well-paying machining jobs are not being filled. Fewer and fewer young people are entering the trade. And the average of a highly skilled machinist is approaching 58.

Companies are unable to plan for growth, while the unemployed abd those on the bottom rungs of the job ladder are not able to take advantage of these openings. The possibility of sustained manufacturing job growth will disappear unless this well documented skills shortage is successfully addressed.

Surveys, telephone calls, anecdotal evidence, and a check of the help wanted ads for skilled machinists all point to one conclusion: a comprehensive and coordinaed program designed to deliver training in this field is essential. The job is too large, and the costs are too great for any one institution. By pooling resources, success is possible.

A "career ladder" approach to metalworking training will be established by combining the best of what each individual institution has to offer in one coordinated delivery system. Such coordination would allow a person to simultaneously accumulate college credits at Springfield Technical Community College and training hours towards a full apprenticeship in machining through the Massachusetts Division of Apprentice Training. By having a wide range of training programs offered at various skill levels, a worker will be able to advance in the trade. Employers will know that their workforce can be upgraded and in step with rapidly changing technology, and that new workers can be trained to fill future job openings.

The Machine Action Project, National Tooling and Machining Association, Western Massachusetts Precision Institute, Hampden County Employment and Training Consortium, Massachusetts Career Development Institute, Western Massachusetts Regional Education Center of the Massachusetts Department of Education, Massachusetts Department of Employment and Training, Massachusetts Department of Labor and Industries - Division of Apprentice Training, United States Department of Labor - Bureau of Apprenticeship and Training, and Springfield Technical Community College agree to undertake the following tasks together:

1. All institutions are committed to the development of recruitment strategies and courses designed to bring more youth, linguistic minorities, women and people of color into the machining occupations.

Special attention must be paid to the issues of day care, transportation, and remedial math, reading and English programs if these efforts are to succeed. Provisions must be made for English as a Second Language (ESL) instruction, when necessary. Counseling must be expanded as well. MAP will work with training providers to develop programs to ensure the success of these recruitment efforts.

2. A common curriculum will be used by training institutions offering training in metalworking. This will make it possible for individuals to assess their progress and plan future training. It will help trianing providers plan their course offerings, and facilitate overall program development. The curriculum will make the "career ladder" approach to training come alive. Course descriptions will outline the competencies achieved. Certificates of completion will be issued at the end of each course or program, detailing skills that have been acquired.

3. A common intake assessment will be used. This will make it possible for an individual to be referred to the proper course or program by any of the participating institutions.

4. Representatives of each training provider will meet, at minimum, quarterly to plan course offerings, work on curriculum development and review, and other issues related to this endeavor.

5. Upgrading and special focused courses will be planned, based on industry research conducted by the Machine Action Project. MAP research will be made available to all training providers on a regular basis. Special attention will be paid to the recruitment of linguistic minorities, women and people of color into these courses, according to each institution's admissions recruitment policies.

6. MAP will prepare brochures in English and Spanish, as well as other languages as the need arises, to be mailed to all metalworking firms and industrial labor unions in Hampden County. These brochures will list the training courses to be offered for each academic year (September 1 to June 30), and will contain the prerequisites for each program.

* * * * * * * * * * *

Each institution will use its existing resources to provide the services and to complete the tasks outlined herein to insure the success of this coordination effort.

Massachusetts Department of Labor and Industries, Division of Apprentice Training: The Division will assist each employer in the development of on-the-job training curricula. This will include monitoring each apprentice's progress until such time as a central coordinating mechanism is established. The Division will work with employers to encourage the participation of women, linguistic minorities and people of color in the Apprentice program. When enough apprentices attend related classes, funding can be provided for instructors through the Massachusetts Department of Education's Division of Occupational Education, contingent upon availability. We will strongly recommend that six month's credit towards the Machining

Apprenticeship be awarded for successful completion of the introductory machining program at the Western Massachusetts Precision Institute or the Massachusetts Career Development Institute. We will recommend one and one half years credit for completion of a vocational/technical high school machine trades program.

Western Massachusetts Regional Education Center: Through the Regional Office, the vocational/technical high schools with Massachusetts General Laws, Chapter 74 approved programs will offer evening upgrading programs in areas of blueprint and math skills, advanced set up, basics of computer numerical control machining, and other areas as defined by training needs surveys. Interested schools will work with other training providers to develop a common curriculum and to formulate a marketing program to enhance the image of the machining trades. The Regional Office will provide technical assistance and work with training providers in the development of recruitment and follow-up strategies to bring more women and people of color into machining programs. The Regional Office will also participate in the formulation of curricula for future Bay State Skills Corporation grant proposals.

Hampden County Employment and Training Consortium (HCETC): The HCETC serves as the administrative agency for federal and state job training funds within the Hampden County Service Delivery Area (SDA). The Consortium will: ensure that the coordinated intake system for the SDA acts as a partner in the outreach, assessment and referral process for machining training so that individuals are referred to the institution that can most appropriately meet their needs; help develop and implement recruitment strategies to bring more youth, linguistic minorities, women and people of color into the printing occupations; and in coordination with the Regional Employment Board/ Private Industry Council planning process, insure that JTPA and other training resources are made available for graphic arts/printing training in Hampden County.

Machine Action Project (MAP): The Machine Action Project will convene coordination meetings, provide training institutions with accurate information on specific training needs in the region, make its data base of area metalworking firms available, and assist in the final articulation of a credit and apprenticeship hours program. MAP will work with training providers to develop recruitment strategies aimed at women, linguistic minorities and people of color. MAP will assist in the development of follow-up programs to keep track of individuals leaving training. MAP will work with others to secure funds to continue the overall coordination effort and follow-up programs on a permanent basis.

Massachusetts Career Development Institute (MCDI): MCDI will offer short-term courses in various aspects of machinings as well as a 22 week (660 hour) Tool and Die Program. MCDI is open all year and can start courses for individuals at any time. Examples of short-term course offerings include basic math, blueprint reading, engine lathe technology, and fundamentals of quality control. MCDI will support the Women in Machining Program with its counseling staff and day care referral program and provide the initial hands-on training.

National Tooling and Machining Association (NTMA): The NTMA will offer technical assistance in the development of curriculum and work in consultation with the Project to provide industry input into course design. The NTMA will encourage business participation in this program.

Pioneer Valley Central Labor Council (PVCLC): The PVCLC will assist in the recruitment effort for the machining program and work closely with dislocated workers to inform them of available training programs. A Council representative will participate in future coordination meetings and help develop recruitment programs for youth, women, linguistic minorities, and people of color to assist them in getting into training programs in machining and other technology fields.

Private Industry Council (PIC): The PIC will have oversight responsibility for the coordination project. It will assist in obtaining needed funds for the implementation of this effort, particularly in the area of developing programs for minorities, women, and high school dropouts. The PIC will explore the possibility of developing similar coordination programs in other trades based on this model.

Springfield Action Commission (SAC): SAC is the designated Community Action Agency for the city of Springfield. SAC is committed to empowering and assisting low income people to break out of the bonds of poverty. Within this context, SAC will actively recruit people for, and support them in, the machining training program. Day care and remediation services will be made as accessible as possible to individuals in the machining programs.

Springfield Technical Community College (STCC): The ultimate objective of the College is the establishment of a "Western Massachusetts Center for Advanced Technology". Coupled with current offerings in machining technologies, the Center will provide state-of-the-art machine and electronics training capabilities in fields like laser machining, robotics, and Computer-assisted design and manufacturing. STCC will set up a credit-granting program for individuals pursuing machining training as part of the "career ladder." STCC, through its Admissions Office and its Women in Technology Program, will work with other training providers to develop recruitment materials designed to encourage more linguistic minorities, women and people of color to consider machining and other technological fields as career options.

Western Massachusetts Precision Institute (WMPI): WMPI will offer its introductory course to qualified applicants as part of the training offered. We will encourage students to go on to the Apprenticeship as well as pursue additional credits at STCC. The school will work with other training institutions to coordinate specialized offerings and develop recruitment strategies designed to bring more woemn and minorities into the machining occupations. Members of the Tooling and Machining Association will act in an advisory capacity to the overall coordination effort to ensure courses offered meet industry needs and standards.

MACHINIST
TRAINING COORDINATION TABLE

IF AN INDIVIDUAL IS A GRADUATE OF:	THEN STCC WILL AWARD THE LISTED CREDIT HOURS TOWARD AN ASSOCIATES DEGREE IN MACHINE TECHNOLOGY	AND MASS. DIVISION OF APPRENTICESHIP TRAINING WILL AWARD THE LISTED HOURS TOWARD JOURNEYMAN'S PAPERS WITH EMPLOYER O.K.	UPON PRESENTATION OF THE DOCUMENT CITED BELOW
MCDI MACHINE TRAINING PROGRAM	3 - INTRO TO BLUEPRINT READING	SIX MONTHS OR 1000 HOURS	CERTIFICATE OF COMPLETION WITH ATTACHED RECORD OF COMPETENCIES
MCDI TOOL AND DIE TRAINING PROGRAM	3 - INTRO TO BLUEPRINT READING 5 - MACHINING ONE 8 - TOTAL	ONE YEAR OR 2000 HOURS	CERTIFICATE OF COMPLETION WITH ATTACHED RECORD OF COMPETENCIES
WMPI MACHINE TRAINING PROGRAM	3 - INTRO TO BLUEPRINT READING	SIX MONTHS OR 1000 HOURS	CERTIFICATE OF COMPLETION
WMPI EVENING TOOL AND DIE TRAINING PROGRAM	3 - INTRO TO BLUEPRINT READING 5 - MACHINING ONE 8 - TOTAL	ONE YEAR OR 2000 HOURS	CERTIFICATE OF COMPLETION
COMM. OF MASS. VOC/TECH HS MACHINE TRAINING PROGRAM	MAXIMUM OF 8 BASED ON RESULTS OF CHALLENGE EXAMS	ONE AND ONE HALF YEARS OR 3000 HOURS	SCHOOL DIPLOMA WITH TRANSCRIPT
D.O.E. OCC/ED EVENING MACHINE RELATED TRAINING PROGRAM	TO BE DETERMINED BASED ON CURRICULUM CONTENT.	QUALIFIES FOR RELATED COURSE INSTRUCTION CREDIT (NEGOTIATED WITH EMPLOYER)	CERTIFICATE OF COMPLETION
STCC MACHINING TECHNOLOGY TWO YEAR PROGRAM	ASSOCIATES DEGREE IN MACHINE TECHNOLOGY	QUALIFIES FOR RELATED COURSE INSTRUCTION CREDIT (NEGOTIATED WITH EMPLOYER)	ASSOCIATES DEGREE

COORDINATED TRAINING AGREEMENT

GRAPHIC ARTS

COORDINATED GRAPHIC ARTS TRAINING
MEMORANDUM OF AGREEMENT

* * * * * * * * * * *

MARCH 20, 1990

Signing Organizations and Agencies:

Hampden County Employment and Training Consortium

Hampden County House of Correction

Holyoke Public Schools

LaJustice Printing Company

Machine Action Project/Project CREATE

Massachusetts Career Development Institute

Massachusetts Department of Education, Western Massachusetts Regional Education Center

Massachusetts Department of Employment and Training

Massachusetts Department of Labor and Industries, Division of Apprentice Training

Massachusetts Industrial Services Program

Springfield Public Schools

Springfield Technical Community College

United States Department of Labor, Bureau of Apprenticeship and Training

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COORDINATED GRAPHIC ARTS TRAINING
MEMORANDUM OF AGREEMENT

* * * * * * * * * * *

SIGNATURE PAGE

Raymond Jarvis, Executive Director
Hampden County Employment &
Training Consortium

George Counter, Superintendent
Holyoke Public Schools

Anthony Molé, Director
Massachusetts Career Development Institute

Jill Alexander, Director
Massachusetts Department of Labor and
Industries, Division of Apprentice Training

Peter Negroni, Superintendent
Springfield Public Schools

John O'Shaughnessy, Massachusetts Director
United States Department of Labor,
Bureau of Apprenticeship and Training

Nicholas Mele, Regional Director
Massachusetts Department of Employment
and Training

Michael Ashe, Sheriff
Hampden County House of Correction

Robert Forrant, Project Director
Machine Action Project, Project CREATE

Joseph Cangro, Team Leader
Western Massachusetts Regional Education
Center

Suzanne Teegarden, Director
Massachusetts Industrial Services Program

Andrew Scibelli, President
Springfield Technical Community College

Edward Sullivan, Proprietor
LaJustice Printing Company

Signed March 20, 1990.

COORDINATED GRAPHIC ARTS TRAINING
MEMORANDUM OF AGREEMENT
MARCH 20, 1990

Graphic arts and printing comprise a critical employment sector in the Hampden County area. Project CREATE has established that there are more than 85 printing operations in Hampden County alone, excluding in-house printing departments and copying/printing services. Labor market research has revealed a pervasive skilled labor shortage in the printing industry. Visits and calls to over twenty-five printing operations and more than a dozen training programs demonstrate a pressing need for skilled technicians. A typical advertisement for an image assembler or press operator might yield twenty to twenty-five applicants but only one or two with the necessary skills. Recent advertisements for a prep room trainee have yielded similar results.

Massachusetts ranks 8th in the U.S. in printing activity, with 28,929 employees and 1,095 establishments. The printing industry is one of the top three manufacturing sectors in the state. From 1982 - 1988 New England printing employment grew 17% as all other manufacturing employment decreased 7% (New England Printer and Publisher, July 1989). Connecticut ranks 20th in the U.S. in printing activity. Many graduates of Hampden County graphic arts training programs are drawn to the Hartford area to obtain employment, largely due to the starting salary differential.

As in metalworking, the average age of the skilled craftsperson is cause for concern, particularly in the press area. Young workers are not entering the trade in sufficient numbers to replace the existing workforce. Thus, there will be an increased need for skilled workers as the present workforce ages and retires.

There are printing technology programs at vocational/technical high schools and at two- and four-year colleges. However, the high schools are producing too few technicians to meet the local industry's needs, while the colleges are primarily preparing students for management rather than production positions. The printing technologies program heads at the local training institutions echo the need for trained technicians. Instructors report receiving calls from many local printing operations who are in need of new employees. The consensus of both the training providers and employers is that the local demand for trained technicians is quite high, and will be for the foreseeable future.

A comprehensive and coordinated program designed to deliver training in printing is essential. The job is too large and the costs are too great for any one institution. By pooling resources, success is possible.

A "career ladder" approach to graphic arts/printing training will be established by combining the best of what each individual institution has to offer in one coordinated delivery system. Such coordination would allow a person to simultaneously accumulate college credits at Springfield Technical Community College and training hours towards a full apprenticeship in the printing trades areas through the Massachusetts Division of Apprentice Training. By having a wide range of training programs offered at various skill levels, a worker will be able to advance in the trade. Employers will know that their workforce can be upgraded and in step with rapidly changing technology, and that new workers can be trained to fill future job

openings.

The Machine Action Project/Project CREATE*, Hampden County Employment and Training Consortium, Hampden County House of Correction, Holyoke Public Schools, Massachusetts Career Development Institute, Western Massachusetts Regional Education Center of the Massachusetts Department of Education, Massachusetts Department of Employment and Training, Massachusetts Department of Labor and Industries - Division of Apprentice Training, United States Department of Labor - Bureau of Apprenticeship and Training, Massachusetts Industrial Services Program, Springfield School Department, and Springfield Technical Community College agree to undertake the following tasks together:

1. All institutions are committed to the development of recruitment strategies and courses designed to bring more youth, linguistic minorities, women and people of color into graphic arts occupations. Each institution has an approved procedure policy for recruitment and admissions; each institution will adhere to said policy.

Special attention must be paid to the issues of day care, transportation, and remedial math, reading and English programs if these efforts are to succeed. Provisions must be made for English as a Second Language (ESL) instruction, when necessary. Counseling must be expanded as well. MAP will work with training providers to develop programs to ensure the success of these recruitment efforts. Support services offered by the Departments of Welfare and Employment and Training should be utilized whenever applicable.

2. A competency-based curriculum will be developed for use by training institutions offering training in graphic arts/printing technology. This will ensure that the curricula used by each training vendor covers the same basic competencies in each area of training. In order to accomplish this task, the institutions must be committed to meeting regularly to create this competency-based core curriculum. MAP will assist in the coordination of this goal as an integral step in the implementation of the Agreement. The Western Massachusetts Regional Education Center and the Vocational Curriculum Resource Centers will provide assistance in curriculum development and revision.

A competency-based curriculum will make it possible for individuals to assess their progress and plan future training. It will help training providers to plan their course offerings and facilitate overall program development. The curriculum will make the "career ladder" approach to training come alive. Course descriptions will outline the competencies achieved. Certificates of completion will be issued at the end of each course or program, detailing skills that have been acquired.

3. A competency-based assessment process will be used by every training institution. This will make it possible for individuals to be referred by the participating institutions to the program best suited to their needs.

*The Machine Action Project is the parent project of both Project CREATE and High Tech '90, U.S. Dept. of Education, Office of Adult and Vocational Education Cooperative Demonstration Projects. Project CREATE will conclude its funding cycle as of 9/30/90, with High Tech '90 assuming the role of Project CREATE. For clarity, MAP will be used to refer to both projects.

4. Representatives of each training provider will meet, at minimum, quarterly to plan course offerings, work on curriculum development and review, and other issues related to this endeavor. A biannual review will take place for the purpose of amending the credits and hours set forth by this agreement to keep current with rapidly changing technology in the graphic arts/printing field. The first meeting will take place during February, 1992, to be coordinated by the Machine Action Project. Each training provider, through its own institutional advisory board, will keep current with state-of-the-art advances in the industry.

5. Upgrading and special focused courses will be planned, based on industry research conducted by the Machine Action Project. MAP research will be made available to all training providers on a regular basis. Special attention will be paid to the recruitment of linguistic minorities, women and people of color into these courses, according to each institution's admissions recruitment policies.

6. MAP will prepare brochures in English and Spanish, as well as other languages as the need arises, to be mailed to all printing and graphic arts firms and industrial labor unions in Hampden County. These brochures will list the training courses to be offered for each academic year (September 1 to June 30), and will contain the prerequisites for each program.

* * * * * * * * * * *

Each institution will use its existing resources to provide the services and to complete the tasks outlined herein to insure the success of this coordination effort.

United States Department of Labor, Bureau of Apprenticeship and Training and Massachusetts Department of Labor and Industries, Division of Apprentice Training: The organizations will assist each employer in the development of on-the-job training curricula. This will include monitoring each apprentice's progress until such time as a central coordinating mechanism is established. The organizations will work with employers to encourage the participation of women, linguistic minorities and people of color in the Apprentice program. When enough apprentices attend related classes, funding can be provided for instructors through the Massachusetts Department of Education's Division of Occupational Education, contingent upon availability. We will strongly recommend that six month's credit towards the Printing Apprenticeship be awarded for successful completion of the introductory graphic arts programs at the Massachusetts Career Development Institute and the Hampden County House of Correction. Apprenticeship credit for other adult vocational programs will be determined, based on curriculum content. We will recommend one and one half years credit for completion of a vocational/technical high school graphic arts program.

Western Massachusetts Regional Education Center: Through the Regional Office, the vocational/technical high schools with Massachusetts General Laws, Chapter 74 approved programs will offer evening entry-level and cross-training programs* in graphic arts, and offer skills upgrading courses* in areas defined by training needs surveys. Interested schools will work with other training providers to develop a common curriculum and to formulate a marketing program to enhance the image of the printing trades. The Regional Office will provide technical assistance and work with training providers in the development of recruitment and

*all programs are contingent on funding from various external sources

follow-up strategies to bring more women and people of color into graphic arts programs. The Regional Office will also participate in the formulation of curricula for future Bay State Skills Corporation grant proposals.

Additionally, through facilities at Dean Technical High School, Putnam Vocational-Technical High school and other schools with Chapter 74 approved programs, entry-level programs* will be offered for adults interested in entering the printing trades. Such programs may take place within the regular day program on the basis of available slots. MAP will assist in labor market and skills research and act as a liaison with industry.

Hampden County Employment and Training Consortium (HCETC): The HCETC serves as the administrative agency for federal and state job training funds within the Hampden County Service Delivery Area (SDA). The Consortium will: ensure that the coordinated intake system for the SDA acts as a partner in the outreach, assessment and referral process for graphic arts/printing training so that individuals are referred to the institution that can most appropriately meet their needs; help develop and implement recruitment strategies to bring more youth, linguistic minorities, women and people of color into the printing occupations; and in coordination with the Regional Employment Board/ Private Industry Council planning process, insure that JTPA and other training resources are made available for graphic arts/printing training in Hampden County.

Machine Action Project (MAP): The Machine Action Project will convene coordination meetings, provide training institutions with accurate information on specific training needs in the region, make its data base of area printing firms available, and assist in the final articulation of a credit and apprenticeship hours program. MAP will continue to work with training providers to develop recruitment strategies aimed at women, linguistic minorities and people of color. MAP will assist in the development of follow-up programs to keep track of individuals leaving training. MAP will work with others to secure funds to continue the overall coordination effort and follow-up programs on a permanent basis.

Hampden County House of Correction: The Hampden County House of Correction will offer a 15 week, 450 hour training program in graphic arts for eligible inmates. Trainees will be admitted into the program monthly. The Hampden County House of Correction will provide counseling; assisted placement will be provided through the Springfield Employment Resource Center at MCDI. Basic skills remediation, ESL and GED programs will also be provided.

Massachusetts Career Development Institute (MCDI): MCDI will offer a 16 week, 400 hour training program in graphic arts. Enrollment and entry in this course will be open. MCDI will provide assessment, counseling and assisted placement. Academic remediation, ESL and GED programs will also be provided.

Massachusetts Industrial Services Program (ISP): ISP will work collaboratively with DET and training providers (including the vocational/ technical high schools) to encourage ISP-funded projects to offer training in graphic arts/printing to interested dislocated and 'about to be dislocated' workers, according to labor market demand. MAP will provide ISP with labor market data pertaining to the regions served by the dislocated workers centers.

*all programs are contingent on funding from various external sources

Springfield Technical Community College (STCC): Coupled with current offerings in printing technologies, the College may offer specific skills upgrading courses, when feasible, for printing technicians within the industry. STCC will set up a credit-granting program for individuals pursuing graphic arts/printing training as part of the "career ladder." Through articulation agreements with Rochester Institute of Technology and other 4-year colleges, the career ladder will extend to the Bachelor's degree. STCC, through its Admissions Office and its Women in Technology Program, will work with other training providers to develop recruitment materials designed to encourage more linguistic minorities, women and people of color to consider printing and other technological fields as career options.

GRAPHIC ARTS COORDINATED TRAINING TABLE

IF AN INDIVIDUAL IS A GRADUATE OF:	THEN STCC WILL AWARD (UP TO) THE LISTED CREDIT HOURS TOWARDS AN A.S. DEGREE IN GRAPHIC ARTS TECHNOLOGY	AND MASS. DIV. OF APPRENTICE TRAINING WILL AWARD THE LISTED HRS TOWARDS JOURNEY PAPERS W/ EMPLOYER'S APPROVAL	AND US DOL, APPRENTICESHIP & TRAINING WILL AWARD THE LISTED HOURS TOWARDS JOURNEY PAPERS W/ EMPLOYER'S APPROVAL	UPON PRESENTATION OF THE DOCUMENT CITED BELOW:
M C D I. GRAPHIC ARTS TRAINING PROGRAM	3 - TYPOGRAPHY AND COPY PREP 3 - INTRO TO PRINTING 1 - BASIC KEYBOARDING	SIX MONTHS OR 1000 HOURS (OR MORE, SUBJECT TO EMPLOYER'S APPROVAL)	SIX MONTHS OR 1000 HOURS (OR MORE, SUBJECT TO EMPLOYER'S APPROVAL)	CERT OF COMP WITH ATTACHED RECORD OF COMPETENCIES
HAMPDEN COUNTY JAIL GRAPHIC ARTS TRAINING PROGRAM	3 - TYPOGRAPHY AND COPY PREP 3 - INTRO TO PRINTING 1 - BASIC KEYBOARDING	SIX MONTHS OR 1000 HOURS (OR MORE, SUBJECT TO EMPLOYER'S APPROVAL)	SIX MONTHS OR 1000 HOURS (OR MORE, SUBJECT TO EMPLOYER'S APPROVAL)	CERT OF COMP WITH ATTACHED RECORD OF COMPETENCIES
ADULT VOC GRAPHIC ARTS COURSES/ENTRY LEVEL AND SKILLS UPGRADING	TO BE DETERMINED, BASED ON CURRICULUM CONTENT	QUALIFIES FOR RELATED COURSE INSTRUCTION CREDIT (NEGOTIATED WITH EMPLOYER)	QUALIFIES FOR RELATED COURSE INSTRUCTION CREDIT (NEGOTIATED WITH EMPLOYER)	CERT OF COMP WITH ATTACHED RECORD OF COMPETENCIES
COMMONWEALTH OF MASS. VOC/TECH HIGH SCHOOL GRAPHIC ARTS PROGRAMS	3 - TYPOGRAPHY AND COPY PREP 3 - INTRO TO PRINTING 1 - BASIC KEYBOARDING 3 - BASIC LITHO IMAGE ASSEMBLY 3 - LAYOUT AND COPY PREP	9 MONTHS OR 1500 HOURS AND RELATED COURSE INSTRUCTION CREDIT (NEGOTIATED WITH COOP EMPLOYER)	9 MONTHS OR 1500 HOURS AND RELATED COURSE INSTRUCTION CREDIT (NEGOTIATED WITH COOP EMPLOYER)	SCHOOL DIPLOMA WITH TRANSCRIPT
COMMONWEALTH OF MASS. VOC-TECH H.S. POST-GRAD GRAPHIC ARTS PROGRAMS	TO BE DETERMINED, BASED ON CURRICULUM CONTENT/LENGTH OF STUDY	QUALIFIES FOR RELATED COURSE INSTRUCTION CREDIT (NEGOTIATED WITH EMPLOYER)	QUALIFIES FOR RELATED COURSE INSTRUCTION CREDIT (NEGOTIATED WITH EMPLOYER)	CERT OF COMP WITH ATTACHED RECORD OF COMPETENCIES
STCC GRAPHIC ARTS CERTIFICATE PROGRAM	27 CREDITS THROUGH DIVISION OF CONTINUING EDUCATION	QUALIFIES FOR RELATED COURSE INSTRUCTION CREDIT (NEGOTIATED WITH EMPLOYER)	QUALIFIES FOR RELATED COURSE INSTRUCTION CREDIT (NEGOTIATED WITH EMPLOYER)	CERT OF COMP WITH ATTACHED RECORD OF COMPETENCIES
STCC GRAPHIC ARTS TECHNOLOGY TWO-YEAR PROGRAM	A.S. IN GRAPHIC ARTS TECH AND TECHNOLOGY AND ELIGIBILITY FOR TRANSFER AGREEMENT WITH RIT	QUALIFIES FOR RELATED COURSE INSTRUCTION CREDIT (NEGOTIATED WITH EMPLOYER)	QUALIFIES FOR RELATED COURSE INSTRUCTION CREDIT (NEGOTIATED WITH EMPLOYER)	A. S. DEGREE IN GRAPHIC ARTS TECHNOLOGY

SKILLS SURVEY FORMS

ENGLISH/SPANISH

SKILLS SURVEY FOR THE PRINTING, AUTOMOTIVE REPAIR AND METALWORKING INDUSTRIES

PROJECT CREATE
HAMPDEN COUNTY EMPLOYMENT & TRAINING CONSORTIUM

THANK YOU FOR TAKING THE TIME TO COMPLETE THE ATTACHED SURVEY. YOUR RESPONSES WILL HELP US TO BETTER UNDERSTAND THE TRAINING AND SKILLS NECESSARY FOR SUCCESSFUL EMPLOYMENT AND ADVANCEMENT IN THESE FIELDS.

ALL RESPONSES WILL REMAIN ANONYMOUS. DO NOT WRITE YOUR NAME ON YOUR FORM. THE QUESTIONS ASKED AT THE END OF THE SURVEY ARE OPTIONAL, AND WILL BE USED SOLELY FOR EXAMINING THE COMPOSITION OF THE WORKFORCE AND THE SHOPS IN YOUR INDUSTRY.

1-3

4

SKILLS SURVEY

5-10

DATE:

11-12

JOB TITLE:

1. Please indicate where you received all of your education and/or training in your field <u>prior</u> to your first job in the trade:
(for example, Dean Technical High School, MCDI Skills Center, Armed Services, co-op placement, GM or other manufacturer sponsored training, community college, etc.)

13-14

15-16

17-18

19-20

How well prepared were you for your first job in the trade? Please answer the questions below:

	VERY UNPREPARED	SOMEWHAT UNPREPARED	UNSURE	SOMEWHAT PREPARED	WELL PREPARED	
2. math skills	1	2	3	4	5	21
3 reading skills	1	2	3	4	5	22
4. interpreting diagrams, manuals, charts or blueprints	1	2	3	4	5	23

5. Have you taken courses to upgrade your job skills following employment? Please indicate which courses and where taken:
(for example, Dean Technical High School, MCDI Skills Center, Armed Services, co-op placement, GM or other manufacturer sponsored training, community college, etc.)

24-25

26-27

28-29

(CONTINUED ON NEXT PAGE) 30-31

How often do you use the following skills in performing your job? Use the scale below:

	ALL THE TIME	FREQUENTLY	OCCASIONALLY	RARELY	NOT AT ALL	
6. Math, such as measurement, computation of fractions or decimals, proportion, etc.	1	2	3	4	5	32
7. Problem solving, such as diagnosis, figuring out what went wrong with a part or piece, adjusting machinery to get it to do what you need it to do.	1	2	3	4	5	33
8. Set up, such as speeds, tools, positioning, for lathes, presses or other machinery.	1	2	3	4	5	34
9. Interpreting blueprints, diagrams or charts.	1	2	3	4	5	35
10. Reading manuals.	1	2	3	4	5	36
11. Reading gauges.	1	2	3	4	5	37
12. Asking coworkers for help in solving problems.	1	2	3	4	5	38
13. Asking your supervisor for help in solving problems.	1	2	3	4	5	39
14. Computer data entry.	1	2	3	4	5	40
15. Operating computer numerical control machinery.	1	2	3	4	5	41
16. Computer set up or typesetting.	1	2	3	4	5	42
17. Computer diagnostics.	1	2	3	4	5	43
18. Computer programming.	1	2	3	4	5	44

(CONTINUED ON NEXT PAGE)

How do you think workers in your trade will be using the following skills in the year 2000? Use the scale below.

	MUCH LESS OFTEN	LESS OFTEN	NO CHANGE	MORE OFTEN	MUCH MORE OFTEN	
19. Math skills	1	2	3	4	5	45
20. Reading skills	1	2	3	4	5	46
21. Interpreting diagrams, manuals, charts or blueprints	1	2	3	4	5	47
22. Computer data entry.	1	2	3	4	5	48
23. Operating computer numerical control machinery.	1	2	3	4	5	49
24. Computer set up or typesetting.	1	2	3	4	5	50
25. Computer diagnostics.	1	2	3	4	5	51
26. Computer programming.	1	2	3	4	5	52

Please circle the number that best describes how you feel about the following statements:

	YES	UNSURE	NO	
27. Will the changes in technology taking place in your trade require a higher level of reading skills?	1	2	3	53
28. Will the changes in technology taking place in your trade require a higher level of math skills?	1	2	3	54
29. My positions in the trade have matched my skill level.	1	2	3	55
30. My positions in the trade have required fewer skills than my actual skill level.	1	2	3	56

(CONTINUED ON NEXT PAGE)

Please circle the number that best describes how you feel about the following statements:

	STRONGLY DISAGREE	DISAGREE	UNSURE	AGREE	STRONGLY AGREE	
31. I would like to remain in the trade.	1	2	3	4	5	57
32. This shop encourages its workers to upgrade their job skills.	1	2	3	4	5	58
33. My job allows me to use the skills I acquired in training.	1	2	3	4	5	59
34. I am able to acquire new skills on the job.	1	2	3	4	5	60
35. I would like to advance my skills.	1	2	3	4	5	61
36. I would like more variety in my job assignments.	1	2	3	4	5	62
37. Skills I learned in other jobs have helped me in the work I do now.	1	2	3	4	5	63

38. What is the one major change in your trade over the last five years? 64–65

66–67

68–69

(CONTINUED ON NEXT PAGE)

The following questions are optional. Information gathered from these questions will help us to understand the composition of the workforce in your trade.

70–71

AGE: SEX: M F 72

RACE/ETHNICITY: 73

__BLACK, NON-HISPANIC
__WHITE, NON-HISPANIC
__HISPANIC
__NATIVE AMERICAN
__ASIAN
__OTHER _____

EDUCATION: 74
(check highest level completed)

__high school graduate OR highest grade completed ____
__G.E.D.
__trade school certificate
__high school graduate
__some college
__college graduate (degree ____)

NAME OF COMPANY: 75–100

YEARS AT THIS WORKPLACE: 101–102

YEARS IN THE TRADE: 103–104

STARTING SALARY FOR FIRST JOB IN THE TRADE (hourly): 105–108

PRESENT SALARY (hourly): 109–112

HOW MANY HOURS DO YOU WORK IN AN AVERAGE WEEK? 113–115

HOW MANY HOURS EACH WEEK DO YOU PARTICIPATE IN ON THE JOB TRAINING? 116–117

PLEASE LIST THE VARIOUS JOBS YOU HAVE HELD IN THE TRADE. 118–119

120–121

122–123

124–125

126–127

CUESTIONARIO PARA TRABAJADORES EN LAS INDUSTRIAS DE IMPRENTA, REPARACION DE AUTOMOVILES Y DE CONSTRUCCION EN METALES (METALISTERIA).

PATROCINADO POR " PROJECT CREATE"
HAMPDEN COUNTY EMPLOYMENT
AND TRAINING CONSORTIUM

LE AGRADECEMOS DE ANTEMANO EL TIEMPO QUE HA DE TOMAR PARA LLENAR ESTE CUESTIONARIO. SUS RESPUESTAS NOS AYUDARAN A COMPRENDER QUE CLASE DE ENTRENAMIENTO Y CUALES DESTREZAS SE REQUIEREN PARA OBTENER EMPLEOS Y PARA AVANZAR EN ESTAS INDUSTRIAS.

TODAS SUS RESPUESTAS PERMANECERAN ANONIMAS. FAVOR DE NO ESCRIBIR SU NOMBRE. LAS PREGUNTAS QUE SE HACEN AL FINAL DE ESTE CUESTIONARIO SON OPCIONALES, Y SERAN USADAS SOLAMENTE PARA EXAMINAR Y COMPRENDER LA COMPOSICION O CARACTERISTICAS DE LOS TRABAJADORES Y DE LOS TALLERES EN ESTAS INDUSTRIAS.

CUESTIONARIO

FECHA: _____

NOMBRE DE SU EMPLEO: _____

1. Favor de indicar todas las escuelas o instituciones donde obtuvo su educación o entrenamiento, antes de su primer trabajo en esta industria.

Refiriéndose a las siguientes áreas, ¿ cuán preparado estaba usted para su primer trabajo en esta industria? Escoja el numero apropiado:

	NO ESTABA PREPARADO EN ABSOLUTO	POCO PREPARADO	NO ESTOY SEGURO	MAS O MENOS PREPARADO	BIEN PREPARADO
2. Destrezas matemáticas	1	2	3	4	5
3. Destrezas de lectura	1	2	3	4	5
4. La habilidad de interpretar diagramas, manuales, planos o dibujos técnicos.	1	2	3	4	5

5. ¿ Después de su primer empleo en esta industria, ha estudiado algún curso para superar sus habilidades en el trabajo? Favor de indicar cuales cursos y donde:
(Por ejemplo, Dean Technical High School, MCDI Skills Center, El Servicio Militar, Co-op placement; otro entrenamiento patrocinado por una compañía como General Motors; o por una Universidad de la comunidad, Etc.).

(Continúa en la página siguiente)

¿CON QUE FRECUENCIA USA USTED LAS SIGUIENTES DESTREZAS EN SU TRABAJO?
Escoja un número de uno a cinco para responder cada pregunta:

		SIEMPRE	FRECUENTEMENTE	DE VEZ EN CUANDO	CASI NUNCA	NUNCA
6.	Las Matemáticas. Por ejemplo, medidas, computo de fracciones y decimales, proporciones, Etc.	1	2	3	4	5
7.	Resolver problemas como diagnósticos, descubrir el error en una pieza defectuosa, Ajustar una máquina para efectuar cierta función, Etc.	1	2	3	4	5
8.	Ajustar las velocidades de las máquinas, Poner en posición (set up) diferentes piezas para los tornos (lathes), prensas u otras máquinas.	1	2	3	4	5
9.	Interpretar los dibujos técnicos, diagramas, o planos.	1	2	3	4	5
10.	Leer manuales técnicos.	1	2	3	4	5
11.	Usar instumentos de calibración (gauges)	1	2	3	4	5
12.	Pedir ayuda a los compañeros de trabajo para resolver problemas sobre un trabajo que está realizando.	1	2	3	4	5
13.	Pedir ayuda a un supervisor para resolver un problema relacionado a un trabajo que está realizando.	1	2	3	4	5
14.	Registrar información en la computadora. (Data entry)	1	2	3	4	5
15.	Operar la máquina de CNC (Computer Numerical Control)	1	2	3	4	5
16.	Preparación (set up) de computadoras o Tipografía (Typesetting).	1	2	3	4	5
17.	Diagnósticos computarizados.	1	2	3	4	5
18.	Programación de computadoras.	1	2	3	4	5

(Continúa en la página siguiente)

En su opinión, en el año 2000, ¿con qué frecuencia van a utilizar los trabajadores en esta industria las siguientes habilidades ? Escoja un número:

	MUCHO MENOS QUE HOY EN DIA	MENOS QUE HOY EN DIA	IGUAL QUE HOY EN DIA	MAS QUE HOY EN DIA	MUCHO MAS QUE HOY EN DIA
19. Las Matemáticas	1	2	3	4	5
20. La Lectura	1	2	3	4	5
21. La interpretación de diagramas, manuales técnicos, planos y dibujos técnicos.	1	2	3	4	5
22. Registro de información en computadoras (Data entry)	1	2	3	4	5
23. La operación de maquinaria de CNC (Computer Numerical Control)	1	2	3	4	5
24. Preparación (set up) de computadoras y tipografía (typesetting)	1	2	3	4	5
25. Diagnósticos computarizados.	1	2	3	4	5
26. Programación de computadoras.	1	2	3	4	5

Favor de indicar cuál es su opinión en cuanto a los siguientes puntos. Coloque un círculo al número apropiado:

	SÍ	NO ESTOY SEGURO	NO
27. Los cambios tecnológicos que están sucediendo en esta industria requerirán niveles más altos de comprensión de lectura.	1	2	3
28. Los cambios tecnológicos que están sucediendo en esta industria requerirán niveles más altos de destrezas matemáticas.	1	2	3
28. Mis empleos en este tipo de industria han estado de acuerdo a mi nivel de habilidad.	1	2	3
29. Mis empleos en este tipo de industria han requerido menos habilidades que las que actualmente tengo.	1	2	3

(CONTINÚA EN LA PÁGINA SIGUIENTE)

FAVOR DE MARCAR CON UN CIRCULO EL NUMERO QUE MEJOR REPRESENTA SU OPINION EN CUANTO A CADA UNA DE LAS SIGUIENTES:

	ABSOLUTAMENTE NO ESTOY DE ACUERDO	NO ESTOY DE ACUERDO	NO SE	ESTOY DE ACUERDO	ESTOY MUY DE ACUERDO
31. Me gustaría permanecer en esta industria.	1	2	3	4	5
32. Esta compañía motiva a los trabajadores a superar sus destrezas de trabajo.	1	2	3	4	5
33. Mi trabajo me permite utilizar las destrezas que aprendí por medio del entrenamiento.	1	2	3	4	5
34. Yo puedo adquirir o aprender nuevas destrezas en el trabajo.	1	2	3	4	5
35. Me gustaría desarrollar más mis destrezas.	1	2	3	4	5
36. Me gustaría más variedad en los trabajos que me asignan en la compañía.	1	2	3	4	5
37. Las destrezas que he aprendido en otros empleos han sido útiles para mí en el trabajo que ahora tengo.	1	2	3	4	5

38. ¿ CUAL ES EL CAMBIO DE MAYOR IMPORTANCIA QUE HA OCURRIDO EN SU TIPO DE INDUSTRIA EN LOS ULTIMOS CINCO AÑOS?

(continúa en la página siguiente)

LAS PREGUNTAS SIGUIENTES SON COMPLETAMENTE VOLUNTARIAS. LA INFORMACION COLECTADA POR MEDIO DE ESTAS PREGUNTAS NOS AYUDARA A COMPRENDER LA COMPOSICION (O CARACTERISTICAS) DEL PERSONAL EN SU TIPO DE INDUSTRIA.

SU EDAD: _____ SEXO M F

SU RAZA O GRUPO ETNICO: _____

SU NIVEL ESCOLAR (EDUCACION):

ESCOJA EL NIVEL MAS ALTO QUE COMPLETO EN LA ESCUELA:

__Escuela Elemental 1 2 3 4 5 6

__Escuela intermedia o pre-vocacional 7 8 9

__Escuela secundaria 10 11 12

__ G.E.D. Diploma de Equivalencia de la Escuela Superior.

__ Graduado de la Escuela Superior (Secundaria)

__ Certificado de Escuela Vocacional.

__ Algunos créditos universitarios.

__ Graduado de la Universidad. Título: _____

NOMBRE DE SU COMPAÑIA: _____

¿CUANTOS AÑOS LLEVA EN ESTA COMPAÑIA? _____

¿CUANTOS AÑOS LLEVA TRABAJANDO EN ESTE TIPO DE INDUSTRIA? _____

¿CUAL ERA SU SALARIO (POR HORA) EN SU PRIMER EMPLEO EN ESTE TIPO DE INDUSTRIA ? $_____

¿CUAL ES SU SALARIO ACTUAL (POR HORA) ? $_____

¿CUAL ES EL PROMEDIO DE HORAS QUE USTED TRABAJA A LA SEMANA? _____ HORAS.

¿CUANTAS HORAS A LA SEMANA PARTICIPA USTED EN ENTRENAMIENTO OCUPACIONAL EN EL TRABAJO ? _____

FAVOR DE INDICAR LOS TRABAJOS QUE USTED HA TENIDO EN ESTE TIPO DE INDUSTRIA:

_____

_____

_____

_____

_____

ACCESS NEWSLETTERS

ACCESS

Providing information to educators, trainers, human service agencies and industry on activities to enhance access to high-skilled, well-paying jobs in high-technology fields.

Project CREATE **Fall Issue, 1990**

SKILLS AND TECHNOLOGICAL CHANGE

"WHAT DO WORKERS HAVE TO SAY?"

A Project CREATE survey of 209 workers employed in three highly skilled trades - metalworking machining, automobile repair, and graphic arts/printing - offers substantial evidence that workers understand how technology has altered and, even more significantly, will change in the future the way their work environment is shaped and the demands it will place on both their physical and mental skills.

The interviews undertaken for this research yielded a consensus of opinion of workers and employers with regard to common cognitive and occupational skills. Math, reading, measurement, problem solving and interpreting (e.g., blueprints, diagrams and charts) are skills that cut across trade areas. Similarly, set up, data entry, machine operation, computer diagnostics and programming will be the skills required of workers in all high technology trades of the future. Competency-based vocational education must be examined in light of the issues raised in this report. Research is needed as to whether students should be trained to acquire the common skills necessary for a high technology career. Perhaps specific occupational training should be limited to the cooperative placement, entry level on the job training, or work-based apprenticeship.

Changes are taking place in the economy and labor market. Job content in virtually every employment field is being impacted rapidly and in an all-encompassing way. Experts in workplace technological change estimate that workers will need to be retrained every five years to keep pace with the new technology and 'head' skills required by this evolving work environment. Workers will have to use math and reading skills, and work in problem-solving teams more frequently than ever before.

How do we bridge the transition from high school to work? Can schools and businesses work in partnership towards this goal? How do we enable the workers of the future to utilize the skills they have while keeping abreast of the rapidly changing technology, particularly when our educational system has fallen behind other industrial nations? The future of America's competetive standing in the global economy may be at stake.

As we approach the 21st Century, workers see changes occurring and are acutely aware of their need for new and different skills in order to hold down a job in the workforce of the future. Key survey results are as follows.

MAJOR SURVEY FINDINGS:

❑ A majority of workers across all three trade areas indicated more or much more usage of high technology skills, e.g., computer data entry, operation of computer controlled machinery, and computer programming, in the year 2000.

❑ Workers affirmed that changes in technology will require greater math usage on the job in the year 2000.

❑ A majority of workers across all three trades agreed that changes in technology will require both greater usage and higher levels of reading skills on the job by the year 2000.

❑ The majority of the surveyed workers in all three trades have attended at least one upgrading course, indicating that workers are interested in skills upgrading. Similarly, the majority of respondents strongly agreed that they wanted to advance their skills.

(cont'd. on page 4)

ACCESS
is paid for by a grant from
the U.S. Department of Education,
Office of Vocational & Adult Education

BAD NEWS - GOOD NEWS

FROM PROJECT CREATE TO HIGH TECH '90

This will be the last issue of Access funded by Project CREATE. In it you will find articles summarizing much of what we learned over the last 18 months about training and the access and equity issues we feel are fundamental to the success of any program like this. A Project video, and copies of all curricula developed, research findings, and reports will be deposited shortly in the six Curriculum Coordination Centers of the National Network for Curriculum Coordination in Vocational/Technical Education. Staff will be available to answer any questions and discuss these materials with you.

Access will continue - same name, new dollars - for another 18 months with funding from a second grant (HIGH TECH '90) we received from the U.S. Department of Education Office of Vocational and Adult Education. HIGH TECH '90 is well underway. Training programs are being offered in entry level and advanced machining, graphics and printing, and automotive technologies. In addition, a series of career exploration workshops will be given through a collaboration with area vocational/technical high schools and Springfield Technical Community College.

Newsletter circulation is up to approximately 750 copies. If you have any comments or suggestions for how to improve the newsletter please let us know. If you want to write an article about a training project you are working on give us a call. We can always make space!

TRAINING FOR THE FUTURE:

"COLLABORATION IS THE KEY!"

For the past eighteen months Project CREATE has been at the forefront of an effort involving several Hampden County, Mass. area employers, secondary and post-secondary schools, public sector training providers, federal and state agencies, and community organizations to develop training programs that meet the needs of both trainees and industry.

This training grew out of Summer, 1989 labor market research and focused on 3 trades: high-tech automotive repair; graphic arts/printing; and Computer Numerical Control machine maintenance & repair.

One hundred and seventy-one trainees benefitted from eight skills and upgrading programs taught at Dean Technical High School in Holyoke, Putnam Vocational-Technical High School in Springfield, and Springfield Technical Community College. Our recruitment goal was to attract women, people of color, linguistic minorities, and the underskilled to these programs.

In realizing the grant's goals, lessons were learned about recruitment, access/equity issues, retention, needs of trainees & local industries, internal and ongoing support, testing, mid-point and final evaluation, community and private sector participation, and the necessity to engage all available resources in providing training.

MAJOR LESSONS LEARNED:

RECRUITMENT: CREATE staff, realizing the need to clearly define it's recruitment and retention procedures, developed a twelve step guideline that included: detailing course description, screening tools, recruitment reflecting a proportionate demographic representation, testing, interviews, needs assessment, support services (i.e., tests translated into Spanish, etc.), and trainee selection process.

To help ensure recruitment goals, **CREATE found it essential to directly approach community-based organizations.** Direct mailing and telephone contact was conducted, as well as personal approaches to would-be students at home or place of work. Relevant state and federal training and apprenticeship agencies were also contacted.

INTERNAL SUPPORT: The development of support systems designed to ensure retention was a key to success for a number of linguistic minorities. A meeting conducted in Spanish prior to one automotive program start-up provided better understanding of goals, resources and course format, and instilled a determination to finish that never wavered. This course had a zero drop-out rate. By comparison, an earlier offering, without the meeting, saw 5 out of 7 linguistic minority students leave the course.

Attendance was regularly kept. Any student missing 2 days of class in a row was contacted to determine if steps could be taken to assist him/her. With this kind of personal follow-up, students knew they were being supported and had use of resources they wouldn't normally have access to.

(cont'd on page 3)

SYSTEMIC CHANGES NEEDED

OPENING THE DOORS

"A well planned, well delivered conference". "I was very glad to see a wide range of educational, business and human service professionals working together". "I felt this was a good first step but alot still to be done". "I would have liked to have seen more employer participation". "It was a day well spent". These were some of the comments of the 115 participants who attended the conference **Opening Doors in the Nineties: Workers, Skills and Diversity** held last May 22nd and sponsored by Project CREATE.

Issues discussed at the conference included: the necessity for effective schools and innovative programs which meet the needs of excluded populations; recruitment and retention of women and people of color in these programs; management of a multicultural workforce; and public policy and coalition building. All of these subjects were discussed in the framework of issues of oppression (racism, sexism etc.) which are the root cause of exclusion.

Participants from government agencies called for more networking and better coordination between agencies and with the private sector. Educators emphasized the need for systemic changes to meet the demands of students and the economy. Industry showed interest in reaching out to a multicultural population in light of the dwindling white male labor pool. And community agencies voiced their interest in participating more actively in both the creation of public policy and in building relationships and coalitions with industry, government agencies, the educational sector and other community agencies.

Failure of the educational system to keep up with changing skills needs in the workplace as well as inflexibility to adapt to a diverse student body and their set of needs and resources were two of the critical areas mentioned.

Many of the participants showed interest in continuing to work together after the conference. A series of symposiums/ workshops will take place towards the end of this year under the direction of High-Tech '90 staff to continue work begun at the conference.

A conference report will be published in the month of October and a video produced for the conference will be ready for distribution in the month of November. A report abstract and more information on the video will be published in the next edition of ACCESS.

Anna Mangual

(TRAINING -cont'd from page 2)

TESTING: Pre-testing was conducted for all applicants to identify those who were over or underqualified, rather than being a pass/fail assessment. Those over and underqualified were not accepted in the belief they would either be bored or become overwhelmed, thus losing interest and dropping out, preventing others from having an opportunity to enroll.

Weekly tests were designed and administered by the instructors to stimulate the growth of knowledge. They were 'open book' during class, and meant to prod the students into fully utilizing their text books. Controlled exit tests were given during the last class using the same pre-tests and were used to establish any improvement in knowledge.

EVALUATIONS: Interim evaluations were taken during the third week of training and promptly analyzed. All pertinent, recommended changes, within fiscal limitations, were instituted. Final evaluations were distributed the last night of class, with results used to improve future training.

COMMUNITY and PRIVATE SECTOR PARTICIPATION: Involvement of the private sector in the development of state-of-the-art training curricula is essential to the growth and development of each specific industry.

Automotive course curricula were a collaboration between local repair shops and dealerships, General Motors Corp. (GM), Sun Electric Corp., Mass. Division of Apprentice Training, and Project CREATE. Manuals and text books were donated by GM with high-tech training equipment loaned by the Sun Electric Corp. Late model automobiles were loaned by local dealers and training was conducted at the William J. Dean Technical H.S.

Curriculum for the CNC Maintenance & Repair course was developed by the heads of the electronics, electrical and mechanical departments of Springfield Technical Community College (STCC) and reviewed by the Machine Action Project, shop owners and machine tool builders. This collaboration insured the course would meet the industry's needs, and produced an up-to-date repair curriculum.

Due to excellent private and public sector cooperation, CREATE doubled the number of programs offered and students trained, issued 142 certificates of completion and provided employment/advancement opportunities for many.

For a detailed report on CREATE training programs write the Machine Action Project, 1176 Main Street, Springfield, MA 01103.

Terry Widener

❑ Close to 50% of all workers were using problem-solving skills on the job and most saw this usage increasing over time.

❑ A majority of workers agreed or strongly agreed that their employer encouraged them to upgrade their skills.

❑ Workers are interested in performing a number of functions on the job. A majority agreed or strongly agreed that they wanted more variety in their daily work assignments.

❑ There is a sharp disjuncture between workers who regularly perform traditional machine set-up functions and those who perfrom set-up functions on computer-controlled equipment.

❑ The research findings indicate that the majority of workers are motivated to continue their education. However, it appears that employers are more likely to provide younger workers with the opportunity to obtain training in the usage of new technologies in the workplace, bypassing highly skilled older workers. Thus, older workers who want to be trained to utilize the new technologies must often seek training opportunities on their own.

For a copy of the research report "What Do Workers Have To Say?" write to the Machine Action Project, 1176 Mains St., Springfield, MA 01103.

Keri Heitner - Robert Forrant

ACCESS was printed by inmates at the Hampden County Jail on paper contributed by The Pond-Ekberg Company, Chicopee, MA

VIDEO RENTAL!

ARE YOU INTERESTED IN:

- **ACCESS AND EQUITY ISSUES?**
- **A MULTI-CULTURAL WORKFORCE?**
- **PREPARING YOUR COMPANY TO ENTER THE 21st CENTURY?**

THESE ISSUES AND MORE ARE DEEPLY EXPLORED IN THE VIDEO "OPENING DOORS IN THE NINETIES". THIS 17 MINUTE PRODUCTION WILL HELP YOU TO UNDERSTAND THE NEEDS OF THE CHANGING DEMOGRAPHIC LABOR MARKET. FOR MORE INFORMATION, CONTACT THE MACHINE ACTION PROJECT

TRAINING OPPORTUNITIES!!

FREE TRAINING FOR WESTERN MASS. AREA RESIDENTS IN:

- **GRAPHIC ARTS/PRINTING**
- **AUTOMOTIVE TECHNOLOGY**
- **BASIC/ADVANCED MACHINING**

WOMEN, PEOPLE OF COLOR, LINGUISTIC MINORITIES, DISLOCATED WORKERS AND HIGH SCHOOL DROPOUTS ARE ENCOURAGED TO APPLY. FOR FURTHER INFORMATION, CONTACT ANNA MANGUAL (413) 781-6900 ext. 27

Project CREATE:

Robert Forrant, Project Director
Keri Heitner, Research Analyst
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ACCESS

Providing information to educators, trainers, human service agencies and industry on activities to enhance access to high-skilled, well-paying jobs in high-technology fields.

Project CREATE **Winter Issue, 1990**

OPENING DOORS IN THE NINETIES!

PROJECT CREATE TO HOLD MAY 22 CONFERENCE IN HOLYOKE

United States labor market and workforce issues present an extremely complex picture as we approach the 21st Century:

Employers with a critical need for skilled workers!

Students and workers insecure about their future because of lack of adequate skills!

Women, linguistic minorities and people of color trying to gain access to educational opportunities, skilled trades and occupations from which they have traditionally been excluded!

Labor unions and educators trying to keep up with skills needs of the present and the future!

Project CREATE is sponsoring a conference that will address these and other critical labor market issues.

OPENING DOORS IN THE NINETIES: Workers, Skills and Diversity will bring together employers, educators, community organizations, labor unions and governmental agencies to work on collaborative approaches to the situations they all face.

The highlight of the conference will be workshops in which small groups will work intensively on specific issues of their choice, including: Management of a Multicultural Workplace; Recruitment and Hiring; Placemen andRetention;, Cross-Training; Management of a Multicultural Classroom; and Coalition Building to Effect Policy Change.

Workgroup efforts will result in recommendations for policymakers and specific strategies for each participant to take back to their workplace to implement.

OPENING DOORS IN THE 90's will be held at Mont Marie Conference Center in Holyoke, MA on May 22nd, 1990. *To register, or for more information contact Anna Mangual at Project CREATE.*

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ACCESS

is paid for by a grant from the U.S. Department of Education, Office of Vocational & Adult Education

COLLABORATING FOR THE FUTURE

A wide array of training institutions in Hampden County offer vocational training to adults and students, ranging from full-time day to part-time evening programs, and everything in between. The variations in programs makes it very difficult for someone interested in obtaining training to know which program is best suited to his or her needs.

Do these programs prepare people for entry-level employment at comparable skill levels? Are skills upgrading programs for employed workers offering the same skills, or do they vary from vendor to vendor? Are the vocational-technical high schools teaching a common curriculum in each trade area? Are graduates of these programs eligible for advanced standing in their programs on the college level? These are critical questions facing educators, training vendors and students/trainees.

These issues led the Machine Action Project to create a coordinated training delivery system in metalworking, through the signing and implementation of the Coordinated Metalworking Training Agreement. The need for a comprehensive, collaborative model for the delivery of vocational-technical training is pervasive. Project CREATE is undertaking efforts to apply this model to printing/graphic arts and automotive technologies.

Printing comprises a critical employment sector in Hampden County and across Massachusetts. The trade has experienced dramatic changes in the usage of increasingly technological equipment across all aspects of production. Entry level and experienced workers must possess high levels of basic math and English competencies along with technical expertise. A comprehensive and coordinated program designed to deliver training in printing is essential. Skilled employees are in demand at every level. The job is too large and the costs are too great for any one institution. By pooling resources, success is possible.

Representatives of local training providers and educational institutions, the Massachusetts Department of Education, the Massachusetts Division of Apprentice Training, the United States Department of Labor, Bureau of Apprenticeship and Training, the Massachusetts Industrial Services Program, local printing establishments and Project Create are working collaboratively to create a coordinated training agreement in printing/graphic arts.

The goal of the Coordinated Training Task Force is to establish a "career ladder" approach to graphic arts/printing training by combining the best of what each individual institution has to offer in one coordinated delivery system. Such coordination would allow a person to simultaneously accumulate college credits at Springfield Technical Community College and training hours towards a full apprenticeship in the printing trades areas through the Massachusetts Division of Apprentice Training. By having a wide range of training programs offered at various skill levels, a worker will be able to advance in the trade. Employers will know that their workforce can be upgraded and in step with rapidly changing technology, and that new workers can be trained to fill future job openings.

Collaborative endeavors in printing training are already in progress. Project CREATE and the Springfield Public Schools, Bureau of Adult Education are co-sponsoring the entry-level and skills upgrading course in graphic arts at Putnam Vocational-Technical High School. Another example of successful collaboration is an entry-level, two hundred hour training course in graphic arts for dislocated workers through the Industrial Services Program Worker Assistance Centers. The course is scheduled to begin February 5th, and will be taught at Dean Technical High School.

The development of a coordinated training agreement is itself a collaborative process. The text of the agreement is derived from group consensus and has evolved through several task force meetings. Members have met in small subgroups to examine and update apprenticeship training guidelines and to come to agreement on credit and apprenticeship hours to be offered. Area employers have been an invaluable resource for information and technical assistance, and helped to ensure that the agreement will best serve the needs of the industry.

The final version of the Agreement will be ready for signing by the end of February. The task of implementation will be discussed in our next issue of ACCESS. *For information about this agreement, please call Keri Heitner.*

The Quality Education for Minorities Project, Cambridge, Ma. has released "Education That Works: An Action Plan for the Educaton of Minorities." For information call (617)253-4417.0r write QEMP, MIT Rm. 26-157, Cambridge, Ma., 02139. A bulk rate is available for multiple copies.

ACCESS welcomes your comments and encourages the submission of articles on issues and activities pertinent to our common mission.
Please send to: ACCESS/ Project CREATE
1176 Main Street
Springfield, MA 01103
(413) 781-6900

CREATE FUNDS 4 HANDS-ON TRAINING PROGRAMS

Labor market research conducted in the Spring of 1987 by the Machine Action Project revealed a glaring labor market contradiction: **there were high levels of female and minority unemployment and/or underemployment while high-skill, well-paying jobs in the local labor market remained unfilled.**

Today's and tomorrow's workforce will consist of people traditionally most underprepared and undertrained—women, linguistic minorities and people of color. Jobs will be highly technical. The result will be a polarized workforce of those with and without math, problem solving and computer literacy skills.

Private industry cannot be solely responsible for closing this skills gap. Collaboration among education and training providers, human service agencies and the private sector is vital! Project CREATE has funded four new high-tech training programs in collaboration with area training institutions: Printing/Graphic Arts, Repair and Maintenance of Computer Numeric Control Machine Tools, Fundamental Automotive Electricity and Electronics, and General Motors manufacturer-specific Automotive Technician training. The programs began in January, 1990 and will run through June.

The printing/graphics technology course is a joint endeavor with the Bureau of Adult Education of the Springfield School Department. This offering is a combination of skills upgrading and basic printing for printers and typesetters interested in expanding their skills base, and for new entrants seeking employment in the industry. The curriculum consists of 90 hours of copy preparation, presswork and bindery operation. Training takes place at Roger L. Putnam Vocational-Technical High School.

A state-of-the-art, 160 hour course in CNC maintenance and repair is taking place at Springfield Technical Community College (STCC). Comprehensive in scope, it includes training in computers, electronics, mechanics, electricity, motor controls, CNC programming, semiconductors and basic machining. Course curriculum was jointly developed by STCC and private industry.

The development of two high-tech automotive technician training courses grew out of collaboration between Project CREATE, the Mass. Division of Apprentice Training, Wm. J. Dean Technical High School of Holyoke, General Motors and several local garages. Both courses, Fundamental Electricity & Electronics and manufacturer-specific training in General Motors on-board computer systems run concurrently at Dean Technical High School, each providing 54 hours of training.

The Fundamental Electricity and Electronics course is designed to provide a solid base for automotive mechanics to enter into the high-skill, high-demand technician field. The curriculum covers wiring diagrams, meter and electronics fundamentals, circuits, ignition systems and more.

Manufacturer-specific training will enable the more advanced mechanic to specialize in the repair and maintenance of General Motors fuel injection and distributorless ignition systems.

For more information on the curricula being used contact CREATE.

WORKING TO WORK

Diana Velez has had to persevere through a lot of troubles to get to the place she is now, and she is very proud and excited to be training as a machinist at the Massachusetts Career Development Institute (MCDI).

Why did she choose machining? She wanted a skill that could get her a good job, was interesting, and paid well. She was not interested in a desk job, and both welding and machining appeared to be worthwhile careers to her. "Besides," she says, "I'm adventurous!"

As one of 15 women in the Women in Machining Program, she loves what she is doing! She really likes "the independent work. It is just me, working with my machine." She also really enjoys the variety of skills that she is learning. "The better I get at machining, the more new things that I learn."

She can not really think of anyone who has been a role model for her entering the trade, but she says "I took to machining right away, it was easy for me. Also, the people here are great, really supportive of me, and the instructors are number one."

Recently, Diana was featured on a WGGB-TV Channel 40 news series entitled "There's No Place Like Home," which focused on the successes of various homeless people. Diana and her three sons, ages 7, 4, and 15 months, have been homeless twice in the recent year. The first time lasted six months, and then she became homeless again over the holidays and early January after her apartment building burned down. She feels that the McKinney program for the homeless, the staff at MCDI, and her new friends have given her the support that she needs to make major changes in her life. Finally, two weeks ago, she was able to find a new home for her family. She feels that her success is encouraging to women on welfare and in training..

Diana takes her machinist training very seriously. She feels that it is important, so that in the future, with a good job, her dedication will pay off. "I want my hard work to be worth

Kathleen McGraw

Project CREATE:

Robert Forrant, Project Director
Keri Heitner, Research & Training Specialist
Anna Mangual, Race/Sex Equity Specialist
Terry Widener, Project & Training Coordinator

MAP RECEIVES 360K GRANT!

The Machine Action Project was notified in December that it will receive a $360,000 grant from the United States Department of Education's (DOE) Office of Adult and Vocational Education. The grant will allow MAP to continue many of the entry level and advanced technology training programs that it has helped to implement over the past two years. With training dollars shrinking throughout the state this is welcome news and should help local firms upgrade skill levels, and workers obtain the kinds of skills they need to get jobs in high technology fields.

Training programs to be offered through Hampden County training providers, Springfield Technical Community College and vocational-technical high schools include basic printing/graphic arts, automotive repair, basic machining, CAD/CAM, and CNC machining.

Central to the grant is MAP's commitment to help provide training in high technology career fields to individuals who have traditionally been excluded from such programs. Women, linguistic minorities, school dropouts, and people of color will be actively recruited and encouraged to enroll in available courses.

The DOE grant was highly competitive with hundreds of applications for funds from across the U.S. We were one of only 35 projects funded! Once again this is because of the high degree of cooperation and help MAP continues to get from industry and education. We thank you.

Robert Forrant

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EQUITY HANDBOOKS AVAILABLE

Two important handbooks in the field of sex equity will be reprinted through a special grant from the Carnegie Corporation. The Handbook for Achieving Sex Equity Through Education, edited by Susan Klein, and the Sex Equity Handbook for Schools, by David and Myra Sadker are considered classics in the field of sex equity. A limited number of handbooks are available at no charge to organizations that plan to use them most effectively.

The Carnegie Corporation, an organization committed to equity and excellence in education, has financed the publication of these handbooks because they are such widely acclaimed tools for educators working towards eliminating the barriers of sex discrimination. The Handbook for Achieving Sex Equity Through Education is a major reference book for educators interested in understanding sex equity in a wide variety of contexts ranging from early childhood to social studies education. The Sex Equity Handbook for Schools is a practical guide designed to help teachers avoid common patterns of sex-stereotyping and sex discrimination in their classrooms. The book will include a newly updated resource directory, a thorough compliation of organizations, materials and resources for achieving sex equity in education.

Organizations wishing to receive free copies of these valuable publications may do so by stating how they plan to use them effectively to support sex equity and how they will encourage others to purchase copies of the handbooks. For an application, write: **Carnegie Project for Sex Equity**, School of Education, University of Massachusetts, Room 124 Furcolo Hall, Amherst, MA 01103, or call Kay Mathers at (413) 586-2755.

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Project CREATE **Fall Issue, 1989**

Training and Support Services for a Changing Workforce

Are We Meeting the Challenge?

Project CREATE held its third Advisory Board meeting on September 15th. Three individuals directly involved in successful local initiatives to provide training and employment to women, people of color and linguistic minorities were the featured speakers.

Panelists Angel Garcia (L) and Heather Warner (r.) stress the importance of support services in training and employment programs.

"DET was becoming innovative at a time when there was a need for innovative programs," according to Angel Garcia, Assistant Director of the Springfield Regional Office of the Massachusetts Department of Employment and Training (DET). While Director of the Holyoke DET Office, Mr. Garcia headed up a program that led to the successful employment of over 100 clients in less than one year's time, drawn from a population with low education levels, no prior work history, and low English proficiency. This effort was successful because a case management approach was used, which provided extensive client follow-up. In addition, bilingual staff was added to the office to facilitate communication. A strong emphasis was placed on addressing clients' needs, including skills assessment and awareness, job search and interview skills, and child care. "As the population became more comfortable coming into the office there was a dramatic increase in the level of intake," according to Mr. Garcia.

Barry Metayer, Coordinator and Grant Writer at the Massachusetts Career Development Institute (MCDI), discussed two workplace education programs at Easco Hand Tools, a manufacturer located in Springfield. Three years ago, the (then) plant manager at Easco approached MCDI, concerned that their transition to computer-based manufacturing would require a far more flexible workforce than the one currently in place. The existing workforce consisted of many older workers with poor English and math literacy and limited machining skills.

Management was committed to training their existing workforce. As a consequence, over the last three years close to seventy-five workers have attended classes in basic literacy and English as a Second Language, and advanced mathematics and blueprint reading. Classes are taught in a classroom at the factory, with Easco providing their workers with one hour of paid release time for every two hours of class time! "The students assist employers with the recruitment of new students for the classes. Management, the unions and the employees have been very enthusiastic about the program." Class attendance has been very good, and 15 GED's have been obtained so far.

Heather Warner of the Machine Action Project spoke about the Women In Machining Program and its success in increasing the number of women entering into machine training. The Women In Machining Program is described in greater detail elsewhere in this newsletter.

(cont. on page 4)

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Office of Vocational & Adult Education

High-Tech Auto Repair: Training for the Future

Scratch the moniker "grease monkey" from your vocabulary. Yesterday's grease monkey is today's high-tech automotive repair technician. Automobile mechanics are more apt to carry meter and electronics fundamentals in their heads than the residue of grease and oil under their fingernails. According to Lee Miskowski, general manager of Ford Motor Corporation's Parts and Services Division, the automotive industry needs to produce at least 32,000 of these highly skilled technicians every year to keep pace with demand. In the 1990's, the Big Three auto makers (Ford, General Motors, and Chrysler) will train 2,000-3,000 computer-literate mechanics, less than one-tenth of those needed for one year!

In response to this critical need for skilled automotive repair technicians, Project CREATE has funded an evening training program in automotive electricity and electronics at the William Dean Technical High School in Holyoke, Massachusetts. This training is divided into two related courses. The basic course is devoted to fundamental automotive electricity and electronics, while the advanced course addresses manufacturer-specific automotive diagnostics. Each course combines both classroom and hands-on training, and convenes twice a week for a total of fifty-four hours of instruction. The basic course is a pre-requisite for enrollment in the manufacturer-specific training.

There has been an overwhelming response to this initiative, far exceeding expectations and capacity. There are twenty-two mechanics from eighteen garages currently enrolled in the basic course. Of these students, one is a woman, seven are Puerto Rican and one is African American.

Three local vocational high school automotive instructors are attending the training as well. This will allow these teachers to upgrade their skills and pass along state-of-the-art knowledge to their students and colleagues.

Thanks to a significant contribution from the General Motors Regional Training facility in Dedham, Massachusetts, Project CREATE is able to re-offer the basic course, concurrent with the GM-specific course, in January. Another key activity is the future scheduling of additional manufacturer-specific courses (Ford, Chrysler, Foreign).

According to Albert Shanker, President of the American Federation of Teachers, "We can close the skills gap only if various sectors of our society work together." This collaboration was evident in the establishment of the automotive electricity and electronics training program at Dean. Project CREATE, the Massachusetts Division of Apprenticeship Training, the Dean Technical High School administration and staff, General Motors, and local repair shops joined forces by combining human and monetary resources, training space, organizational expertise, and individual talents.

This collaboration is expected to continue beyond the first round of training. The need for technology-based training is so great and the response so enthusiastic that an automotive association is being formed, led by the local automotive repair industry. A major focus of the association will be to guarantee the perpetuation of the existing training program.

For further information contact Project CREATE.

- Terry Widener

Skills for the Year 2000

How are changing technologies in automotive repair, printing and machining affecting workers' abilities to stay current and progress in these fields? What academic and vocational skills do workers need to keep up with the changes? What are the common skills and abilities necessary to perform the duties required in these fields? How critical are math and English competency, critical thinking, problem solving, decision making, and interpreting blueprints, diagrams and manuals for the three fields? These are questions currently under investigation by Project CREATE.

Using site visits, job shadowing, case studies of workers, interviews with supervisors, and detailed survey questionnaires, Project CREATE will examine the common skills required of workers as a result of workplace technological change. The implications of the findings for vocational training, recruitment, retention and placement will be addressed, as well.

For more information about this research project, contact Keri Heitner at Project CREATE. We are also interested in hearing about similar or related research.

ACCESS welcomes your comments and encourages the submission of articles on issues and activities pertinent to our common mission.
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Women in Machining: A Model Program

The Machine Action Project (MAP) recently published a report that provides an update on the progress of Springfield's Women in Machining (WIM) program, located at the Massachusetts Career Development Institute (MCDI). WIM is a model program that combines machine training with high support services designed to give women information about the industry, promote networking, and provide role models. This is done through support group meetings, shop tours, guest speakers, and visits with women working in the trade. The report gives an account of the collective experiences of the women in the program, discusses lessons learned, and makes recommendations on how to continue to break down the barriers facing women entering the trade.

Machining trainee Michelle Morgan (r.) with machine shop instructor Dan Carroll (l.)

MAP's interest in starting the WIM program was sparked by the contradiction within the local metalworking industry: while skilled positions offering good wages and great advancement opportunities are left unfilled, women and people of color are virtually absent from area shops. In Hampden County, for example, women constitute less than 1% and people of color only 2.1% of skilled metalworkers (1988 MAP survey).

Often the low numbers of women in skilled trades work is interpreted as a lack of interest, but WIM found that when given exposure, information, and support women chose and enjoyed machining for many of the same reasons as men. WIM trainee Michele Morgan chose machining because "It's a constant challenge. I'm using my hands as well as my brain. Also, there's a product to see at the end of the day. It's tangible. I can see myself progress in my skills and that makes me feel good!" Co-trainee Barbara Ede explains, "Most people say they like machining because it's working with your hands. For me it isn't working with my hands, it's working with blueprints. You can actually read the blueprint. You've got the dimensions, you've got the special language, and you've got a chore to accomplish. Machining is fascinating because each machine is different."

Since June of 1988, 36 women have entered the machining program at MCDI. Prior to the start-up of WIM, typical annual enrollment had been 1 to 4 women. Of the 36 women, twenty-five are white, 9 African American, and 2 Puerto Rican. Eight women have been placed in machining jobs, 21 are in training, and 7 have left the program.

For the 8 women who went to work in the industry, starting salaries ranged from $6 to just over $9 an hour, with the majority earning between $7 and $8. Five of the women are working in shops with very good potential for skills advancement. Two of the women took less skilled jobs after completing 2 months of training. One woman found a job through friends in a small job shop doing semi-skilled work, but took a leave of absence after 2 months on the job. She said that she was getting bored doing large batch work. She is now working in a day care center.

The overall success of the program has attracted the attention of vocational high schools and other training providers looking to diversify their technical and trade programs along gender and racial lines. For more information about the WIM program and a copy of the report, Access, Equity, and Opportunity - WIM: A Model Program write to The Machine Action Project, 1176 Main Street Springfield, MA 01103, or call (413)791-6900.

- Heather Warner

Note: MAP is the parent project of Project CREATE.

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ACCESS layout: Anna Mangual

Are We Meeting the Challenge? (cont. from page 1)

Several issues related to training and employment were brought up during discussions following the presentations. One critical issue is the need for employers to address barriers other than lack of skills, particularly child care and transportation problems. Many skilled workers lack high levels of English language proficiency and are prevented from obtaining jobs requiring an ability to read and write English. For many jobs, this requirement may not be relevant and should be removed.

Companies with large Hispanic workforces often lack Hispanic supervisors. "There are many advantages to grooming bilingual, bicultural supervisors," according to Angel Garcia. "Training programs should be initiated to enable employees to move up a career ladder within the company."

Anthony Mole, Director of MCDI, echoed a concern of many present when he spoke of "the dilemma of business needs versus individuals' training needs. Cooperation between training providers and employers is necessary to meet individual needs, for optimum individual development, and the needs of employers." At MCDI, academics are taught on parallel with occupational training. "The key is to provide the person with the essential academics required for that position."

Businesses want employees quickly, so trainees may take a job prior to completion of their program. At the same time, employers are looking for workers with greater technical skills than ever before. "The bulk of those needing training have as low basic skills as anyone who has entered the training system, at a time when job content and requirements are rapidly changing," according to Robert Forrant, Director of the Machine Action Project and Project CREATE.

One possible solution to the dilemma requires the creation of meaningful, concrete incentives for policymakers and employers to support and provide on the job training. Labor, both union and non-union, must support ongoing training, and apprenticeship programs must be an integral part of the process. This requires commitment and collaboration among employers and the training delivery system. With such a program in place, new workers can acquire basic skills in a training program and deepen their knowledge while at the work site.

Vocational schools can be utilized to provide ongoing training to the workforce at minimal cost to employers. Facilities can be used after hours, with full-time vocational instructors supplementing their income by teaching these courses. Contact between industry and the schools will lead to better provision of services, meeting the needs of both labor and management. The collaboration between continuing education, employer support and apprenticeship training should result in a highly skilled, dynamic workforce.

The demands of the 21st century workplace will require no less than a continual community education and skills program, beginning in pre-school and continuing throughout an individual's entire work life. "Learning has to be continuous because organizations face continual change of products, services, processes, markets, and competition, as well as technology. Since everyone in the organization is caught up in change, everyone must be involved in learning" (Rosow and Zager, Training - The Competitive Edge, 1988).

- Keri Heitner
- Robert Forrant

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Project CREATE **Summer Issue, 1989**

Collaboration Holds The Key!

Skills In The Year 2000: Will We Have Them?

Western Massachusetts shop owners are having great difficulty in locating and retaining the skilled workforce necessary for their businesses to succeed, while at the same time, new entrants to the workforce often lack the skills and training necessary to fill the labor market need. Project CREATE represents a collaborative effort among a variety of education and training providers, human service agencies, and the private sector to enhance access to and retention in technical career training and placement into these well-paying job fields.

Several CREATE Board members after first meeting.

The Advisory Board for Project CREATE met for the first time on June 30. Emotions ran high as members representing education, training, private industry and human service organizations voiced their concerns for the future of the Hampden County labor supply and the future of the people who lack the skills to survive in the present and future economy.

Jon Kratovil of Pond-Ekberg, a printing company, expressed the need to implement programs to recruit people into the trades at the junior high school level and provide incentive for students to continue training at vocational high schools. He also stressed the benefits to both workers and employers of subsidized, on-the-job training. Dick Sunderland, owner of D & S Manufacturing in Westfield, spoke of customer demand for higher quality output at a quickening pace in a very competetive market.

The need to recruit women and minorities to fill the labor market gap was recognized by all who were present. Maria Figueroa of Nueva Esperanza cited the paradox of a labor market shortage concurrent with underemployment and layoffs, echoing how critical it is to provide access for women and people of color to training and opportunity. Maria Morales-Loebl, Director of the Spanish American Union, spoke for many of those present as she stated that the root causes of poverty and related issues that confront women and people of color must be addressed if training programs are to provide good jobs that pay a living wage and allow for advancement in the trade. With guidance from the Advisory Board and its Sex and Race Equity Committee, Project CREATE is committed to addressing these critical issues.

Project CREATE is funded by the U.S. Department of Education, Office of Vocational and Adult Education, in the amount of $309,274.50. The target populations to be served by the Grant include youth, economically disadvantaged, minorities, women, and adult unskilled workers, the populations that will comprise the majority of the workforce of the future.

Keri Heitner

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Office of Vocational & Adult Education

EDITORIAL **ROBERT FORRANT**

The United States is undergoing the longest period of sustained economic expansion in its history. But in spite of that fact, large numbers of women and people of color have not shared in it. Unemployment rates in our cities remain high for these groups. Much of this joblessness is tied to correspondingly high dropout rates in these communities. This comes at a time when demographic data indicates that women and people of color will make up over 60% of all new workers between now and the year 2000.

The introduction of various forms of computer technology in a number of employment fields, including machining, automotive repair, and printing/graphic communications, now necessitates that workers have higher levels of reading, math, and problem solving skills than ever before. If we fail to develop programs that reach young people soon enough and help keep them in school, and we fail to develop initiatives that involve the private sector and the education and training community in recruiting women and people of color into well-paying high technology career fields, economic expansion will lag simply because we lack the workforce needed to run machinery efficiently.

*Project **CREATE** is endeavoring to work with the private sector, education and training institutions, and community organizations to establish training programs that meet these critical labor market needs. **The glaring contradiction - high levels of female and minority unemployment and underemployment while high skill, well-paying jobs remain empty - must be solved if the nation is to provide opportunities for all in the next century.***

*In subsequent issues of **ACCESS** we will write about the specific ways Project **CREATE** is working to resolve this contradiction. We will strive to be as concrete as possible in discussing programs we are implementing and ongoing labor market research. We look forward to hearing from our readers and will print letters received. If you have a "success" story send it to us and we will include it as well.*

Coordinated Metalworking Training Agreement

Career Ladder To Success

Presently in Hampden County, MA, there are more than 350 machining firms representing close to 15,000 jobs with an annual payroll of 400 million dollars. Thanks to the concerted efforts of business leaders, the employment and training system, vocational educators, and the county's human services network, a 'coordinated training agreement' is expected to help address a serious lack of skilled workers, and contribute to the growth of a quality workforce into the year 2000.

Today, many well-paying metalworking machining jobs in Hampden County are not being filled. Fewer young people are entering the trade; new technology, such as computerized numerical controlled machinery, is requiring a higher degree of skills; the average age of a highly skilled machinist is 58; and laid-off employees are in need of new skills training. In order to alleviate this serious lack of qualified workers, a coordinated, comprehensive and innovative approach to metalworking training was established.

On May 16, 1988 the COORDINATED METALWORKING TRAINING AGREEMENT (CMTA) of Hampden County, became a reality. A "career ladder" approach to metalworking training was established by combining the best training services each individual institution has to offer into one coordinated delivery system. In the first coordinated training agreement of its kind in the state of Massachusetts, an individual can pursue general or specialized training in the machining field with the full resources of all the various training providers in Hampden County. A unified curriculum is being established which allows a smooth transition between training providers. When an individual has completed training on one 'rung' of the ladder, then he/she can upgrade his/her skills by moving up to more advanced training.

The "career ladder" links training at the vocational/technical high school level with advanced and evening courses at local community colleges. Courses are available for currently employed workers and new entrants to the trade.

As each phase of training is successfully concluded, the individual will receive a CERTIFICATE OF COMPLETION

(cont. on page 4)

Equity: An Issue of Survival

"Public education in this country is in crisis. America's public schools graduate 700,000 functionally illiterate students every year, and 700,000 more drop out."
(Winning the Brain Race, 1988)

By the year 2000, the majority of all new jobs will require technological literacy, advanced math, and problem-solving skills according to the New England Board of Higher Education (Equity andPluralism, 1989). Studies have shown that U.S. students receive the lowest scores in these and related subjects when compared with students from other nations. A recent survey indicated that four out of five young adults couldn't summarize the main point of a newspaper article, or read a bus schedule, or figure their change from a restaurant bill.

When addressing the issues of alleged "student incompetence" and the shortage of skilled labor, many instructors and employers have related this "recent trend" to a lack of "good students" and "good workers". The implication is that "they don't make them as good as they used to anymore". Such statements obviate and perpetuate the real problems that have triggered the skills shortage contradiction in our economy today.

There is a growing consensus in the nation that the educational system is not meeting the changing needs of our society. It probably never has! Historically, public education in the U.S. has been officially committed to imparting **quality** education for **all citizens equally.** In reality this has not been accomplished.

Quality education would give students the skills needed to perform and succeed in the workplace according to the established needs of industry and the rest of the economy. Yet, except in few individual cases, school curricula did not keep up with changing technologies and the subsequent need for more sophisticated basic skills, leaving students poorly prepared to meet the requirements of today's changing technological economy. Furthermore, education was not offered to all citizens equally. Institutional racism and gender stereotyping left too many out of the best the system had to offer.

Institutional racism has kept people of color isolated from schools that provide a quality education. Lack of extracurricular resources, poor schools with less resources than those located in white neighborhoods, high student-teacher ratios and lower teacher expectations, are some of the reasons for consistent lower academic achievement by minority students. This has resulted in limited access to both higher education and better paying jobs that require advanced skills.

"Poor minority children are undereducated in disproportionate numbers across the country. Academically such children may lag behind the national average by up to two years. In large cities as many as 50 percent of minority children drop out of school. The failure to educate these children makes ever harder the task of rectifying economic and social inequities. Job opportunities reside in service and technology industries, but poor minority youths are the least likely to have the social and academic skills these jobs demand. Unless schools can find a way to educate them and bring them into the mainstream, all the problems associated with unemployment and alienation will escalate."
(Scientific American, Nov.,1988, p. 42)

Gender stereotyping kept, and still keeps, young girls away from educational opportunities that would provide adequate training in math, science and technology-related fields, the very same ones that now offer the most promising and better paying career opportunities; and steered them, at best, into professions that required nurturing and were more "glamorous" and "appropriate for girls".

The best that education had to offer was reserved for the white male. Expectations of him were higher than of any other group of students. He was encouraged to excel in math, following the myth that "boys were naturally good in math and science". Consequently he filled the slots in the workplace that required higher skills and a better knowledge of math and technology-related subjects. As a result, the image of the "good student" and the "good worker" corresponds to that of the white male.

Nevertheless, 65% of new entrants to the workforce between 1985 and 2000 will be women; 43% will be people of color or immigrants; and only 15% white males (Hudson Institute). Changing demographics have, for the first time, forced educators, policymakers and the private sector to take a hard look at educational and workplace access issues because the future of the American economy is now dependent of those who did not receive equal educational opportunities.

(cont. on page 4)

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Coordinated Training, *cont. from p. 2*

with attached record of competencies. Simultaneously, each student will accumulate both, college credits at Springfield Technical Community College, and training-related classroom hours toward full journeyman's papers through the Massachusetts Division of Apprenticeship Training. Example: Completion of Tool and Die Training program will award 3 credits for Introduction to Blueprint Reading and 5 credits for Machining I, totaling 8 college credits and one year or 2000 hours towards journeyman's papers.

By having access to a wide range of training courses, at various skill levels, workers will be able to advance in the trade. Equally important, employers will know that their workforce skills base can be continuously upgraded.

Access to the CMTA program is open to all, with special emphasis on the recruitment and retention of minorities and women. Advertising by news media and brochure is expected to attract many women into this specialized training, as evidenced by successful recruitment into the Women In Machining program.(See the Fall issue of ACCESS for a report on this exciting program).

This CMTA provides access to state-of-the-art instruction and the opportunity to advance in one of the best paying manufacturing careers available in Hampden County. To further acquaint interested parties with this agreement, write to: Project CREATE or THE MACHINE ACTION PROJECT (MAP) at 1176 Main St., Springfield, MA pr call (413) 781-6900. - ***Terry Widener***

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Equity..., *cont. from p. 3*

> *"Once ... 'workforce' meant white men in ties or blue collars... with a plentiful labor supply, few employers had to reach beyond the male Caucasian in his prime except for the least-wanted jobs. ...The years of picky hiring are over. Viscious competition for all sorts of workers - entry-level, skilled, seasoned - has begun. Employers must look to the nonmale, the nonwhite, the nonyoung."*
> *(BusinessWeek, Sept.9, 1988, p. 112)*

Access issuses must carry a strong warning with them: recruitment of women and people of color into training and employment in "non-traditional" fields must provide real access and promotional opportunities. We can no longer think of them as warm bodies to fill entry-level positions as the need arises. This has been the situation for too long! History has shown us a lesson; if we do not offer people a fair chance to develop their natural potentials, eventually society as a whole will be affected. Educators and employers must look at the institutional hurdles barring women and minorities from entering and advancing in specific fields, if we are to have a healthy economy and society.

Anna Mangual

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OPENING DOORS IN THE '90s:

CONFERENCE REPORT

CONFERENCE REPORT

OPENING DOORS IN THE NINETIES: WORKERS, SKILLS AND DIVERSITY

MAY 22, 1990

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I. ACKNOWLEDGEMENTS

Opening Doors in The Nineties: Workers, Skills and Diversity took place thanks to the collaboration and hard work of many people. Project CREATE's Advisory Board and Conference Committee gave input on the basic needs and concerns of the various communities and agencies they represented. The Conference Committee helped us select the issues to focus on and design a conference format. Thanks to all of the Committee members, especially Maria Morales-Loebl, Naomi Klayman, Martha Ceplikas, Wendy Varner and Dorothy Hall for their perfect attendance, insightfulness, and support at conference committee meetings. Thanks also to Vincent Yacavone of the Video Department at Springfield Technical Community College for his tremendous help in producing the Conference video.

My appreciation to consultant Joan Lester-Steinau of the Equity Institute who gave us a lot of emotional support, continuously telling us that "everything's going to be fine". Also thanks to the rest of Institute's staff for making us feel like part of the family. I am grateful to the speakers, panelists and facilitators who shared their expertise and led us through a day of fruitful discussions; and to the recorders because their notes and observations made this report possible.

Project Create and Machine Action Project staff helped in many different ways before and during the Conference. My special thanks to Terry Widener for his work on the mailing list, to Carlos Montes de Oca for sharing his computer expertise and to Bob Forrant for believing in this project. My very special thanks to Angela do Canto whose outstanding skills with details, ability to juggle many tasks and great sense of humor made her the best Assistant Coordinator I could have hoped for.

The CREATE staff hopes you find this report informative and that the issues and questions it raises will motivate people **to work together to ensure that the doors to quality education, training, and economic opportunity open and stay open for all people.**

Anna Mangual, Conference Coordinator
Project CREATE
Springfield, Massachusetts
January, 1991

II. EXECUTIVE SUMMARY

In April, 1988 the U.S. Department of Education funded the Machine Action Project of Springfield, Massachusetts, to undertake training and labor market research activities in several high-technology career fields. As part of this work Project CREATE - Cooperative Resources to Enhance Access to jobs through Technical Education - established an equity component which worked with government agencies, community-based organizations, vocational schools, training institutions and employers to:

1. Disseminate information on our training programs among unemployed and underskilled women, people of color, and linguistic minorities.

2. Help training programs and vocational schools develop recruitment and retention strategies that allow the targetted populations successful access to training and jobs they had traditionally been excluded from.

Several problems were examined in the process:

1. Women, people of color and linguistic minorities quite often lack the basic skills (math/language/mechanical) needed to enter high-tech training.

2. All students are negatively affected by the quality of education in the U.S. People of color, linguistic minorities, and women are harmed the most and yet they are more sharply criticized than other groups in society for lacking skills.

3. Preconceived ideas about "natural" skills and which groups in society have a "work ethic" are pervasive. The direct and frank discussion of these issues is essential if everyone is to have full and equal access to technology education and training programs.

4. There is a lack of discussion between and among public and private sector organizations and employers on such topics as skills needs, labor market trends, and multicultural issues and their impact on training and the workplace.

Project CREATE brought over 125 representatives from education, employment and training, government, community-based organizations, labor, and industry together on May 22, 1990 in a conference - **Opening Doors In The Nineties:Workers, Skills and Diversity** - to begin collaborating on developing approaches and solutions to these problems. The conference was divided into four parts: 1) a video, produced by CREATE staff, depicted workforce and educational issues which limit the access that women, people of color and linguistic minorities have to well paying career fields, 2) a panel, "Creating Blueprints for the Workforce of the Nineties" presented concrete examples of strategies and programs that 'open doors', 3) a workshop, "The 'Ism's' and the 'Wasm's'" dealt with issues of oppression - mainly racism and sexism, and 4) several workgroups were formed so that participants could begin to formulate initiatives that would not only **Open the Doors,** but ***Keep them Open.***

III. INTRODUCTION

Across the country workforce skills demands continue to rise while we suffer from an acute lack of programs to teach these skills. Experts in workplace technological change estimate that workers will need to be retrained every five years to keep pace with the math, reading, computer, and problem-solving skills required by 21st century workplaces. By the year 2000, 90% of all new jobs will require technological literacy, advanced math, and problem-solving skills according to a report by the New England Board of Higher Education (Equity and Pluralism, 1989). Recent studies show that U.S. students receive the lowest test scores in these and related subjects when compared with their counterparts from a number of other countries.

There is a growing national consensus that the educational system is not meeting society's needs. Officially, the public education system has been committed to providing equal, quality education to everyone, but in practice this has not been the case. Quality education would, among other things, give all students the skills needed to perform and succeed in life. Yet, except in a few isolated cases, urban school curricula has not kept up with changing technologies and the subsequent need for more sophisticated education. Institutional racism has often kept people of color out of schools that could provide this educational experience. Lack of resources, high student-teacher ratios and lower teacher and administrator expectations of students, contribute to lower academic achievement. The result has been high drop out rates, and limited access to post-secondary education, and well paying jobs. In addition, gender stereotyping continues to keep young women away from educational opportunities in math, science and technology-related fields. Taken together, this presents a serious problem since 65% of new entrants to the workforce between now and the year 2000 will be women; 43% will be people of color or immigrants; and only 15% white males (Hudson Institute, 1989). The future success of the economy is directly tied to the positive resolution of the issue of access to equal educational and training opportunities.

Programs designed to recruit women, people of color and linguistic minorities into training and eventual employment in non-traditional fields must provide real access and meaningful education and job opportunities. Just preparing people for entry level positions, ones that have historically resulted in a last hired - first fired cycle, sets them up for failure. Educators, training providers, and employers must look at the institutional hurdles women, linguistic minorities and people of color are forced to leap over in their quest for educational and economic opportunity. Working with these populations, programs must be developed to knock the hurdles down.

While the focus of the conference was skills training and access to jobs, the larger issue of equal access to a quality education and post-secondary educational opportunities must be considered as well. The rush to "up-skill" the workforce should not be used, or seen as an opportunity to channel women, people of color, and linguistic minorities into programs designed to simply prepare them for entry level jobs. People should be able to explore a variety of educational and job opportunities, and with proper counseling, make the choice that is best for them.

IV. CONFERENCE PROCEEDINGS

A. CREATING BLUEPRINTS FOR THE WORKFORCE OF THE NINETIES

A panel discussion opened the conference focusing on issues of recruitment, education and training, placement, retention, and hiring in vocational schools, and the workplace. What's needed? What can be done? What works?

Minorities in Vocational Education
Dr. James Jennings, Associate Professor, Political Science
University of Massachusetts
Boston, Massachusetts

Massachusetts is at a social and economic crossroads. Demographic trends indicate that our workforce will increasingly be made up of Blacks and Latinos.

Problems:	Resources:
- Black and Latino youth sector is not flexible and ready to be integrated into productive work opportunities.	- If trained and educated, a highly skilled labor force.
- Educational system not working.	- Vocational education a possibility.
- Combination of graying whites and youthful minority populations.	- Matching resources and needs.

The key: vocational education is a glue — education / employment

Vocational schools have had problems increasing their number of Black and Latino students. Reasons for this include:

1. There is a poor image of vocational schools among minority populations and a perception that these schools are a dumping ground for students without a future.

2. Parental attitudes do not lean towards encouraging their children to enter vocational education due mainly to the above perceptions.
3. There is a lack of role models for students of color since most vocational education teachers are white.

4. Linkages between schools and community organizations are weak.

5. The quality of vocational education, including equipment and curriculum, is not always the best. According to Dr. Jennings "MIT is the best example of what good quality vocational education can aspire to."

In order to respond to these and other problems, public policy changes must be made that:

1. Help make a match between new workforce entrants, skills education and training and economic trends.

2. Encourage pedagogical innovation in schools and training centers.

3. Foster increased awareness about the complexity of interrelated social, economic and educational problems.

Management of a Multicultural Workforce: Implications for Hiring and Retention

Arthur McKew, Director of Human Resources
Friction Materials, Inc.
Lawrence, Massachusetts

Friction Materials' employees are aging white males in a city whose growing population is immigrant Latino. When Friction tried to hire employees they realized that the pool of available workers was comprised mainly of non-English speaking persons. In an effort to prepare the workforce they needed, Friction Materials established a Workplace Education Program which included English as a Second Language (ESL) courses. The firm hired and/or trained bilingual supervisors, educated management on multicultural issues, and instituted policies which reflected its new multicultural environment.

Managing a multicultural workforce involves more than teaching limited English proficient workers how to speak a second language. Management must learn about the new culture (s), preferably by getting involved in the life of the community. Firms also needs to look at their prevalent workplace culture, and find and modify areas of potential conflict. Steps must be taken to create awareness among all workers about the new, multicultural nature of their workplace.

Workplace Education Programs
Alexis Johnson, Executive Director
International Language Institute
Northampton, Massachusetts

Due to rapid changes in technology and the demands placed on the skills of workers, employers are finding it necessary to participate in the education of their employees. Workplace Education Programs are being established nationwide. Education is no longer the sole responsibility of the formal educational system. Learning providers, employers, workers, and their unions need to participate in the development and implementation of workplace programs. The input of an Advisory Board that includes representatives from the company, learning provider, union and community is a key to the success of such efforts.

These programs are not merely classes that happen to be at the worksite. They connect basic education with work skills and work issues. Adult Basic Education, ESL, and General Equivalency Diploma programs are the most commonly set up. For programs to succeed employers must be willing to support their costs and be patient - good programs take time to develop.

Personal Account of a Woman Entering a "Non-Traditional" Career: Barriers and Support
Diana Vélez, Machining trainee
Massachusetts Career Development Institute (MCDI)
Springfield, Massachusetts

Two of the most important things people need when they are considering training are support and information. For women entering non-traditional careers this is essential. Lack of support was a key factor contributing to Diana falling through the cracks as she was growing up. A turning point was meeting people who cared and believed in her. This gave her the "empowering" support to shape her own future.

When unbiased information on available training alternatives was presented, Diana entered machining training at MCDI. There she acquired the skills she needed to be able to earn a living wage for herself and her children. Choosing a "non-traditional" field required an extra-supportive environment. Diana participated in the MAP administered Women in Machining Program during training. The Program had support groups, mentoring, guest speakers, and shop tours. Diana is now a Bilingual Instructor's Aide in the Machining Program at MCDI.

B. THE "ISM'S" AND THE "WASM'S"

A workshop, facilitated by the Amherst, Massachusetts based Equity Institute, was held to help conference participants begin to explore the origins of prejudice and learn ways they could take steps to break down the personal and organizational barriers that limit full participation and collaboration among diverse groups. Workshop goals were:

1. To provide participants with a model for understanding oppression and the interrelatedness of its various forms.

2. To examine how oppression manifests itself in the lives of workshop participants and the people they serve.

3. To identify a range of personal and professional strategies for becoming better allies to discriminated social groups.

The workshop began with an activity on class/ethnic backgrounds focusing on the difficulties and sources of strength each participant had coming from their specific class/ethnic backgrounds. This activity allowed sharing of diverse experiences and the opportunity to appreciate differences and similarities between cultures. Participants began to overcome their fear of working on these issues.

The second activity examined different forms of oppression ("ism's"), and their origins. Oppression was defined as the systematic subjugation of a social group by a group with access to power. Social power was defined as access and availability to resources needed to get what you want and influence others. **Prejudice + Power = "Ism"**.

Specific examples of racism and sexism in the workplace and classroom were discussed. The need to talk about these issues further and become actively involved in interrupting different manifestations of oppression was acknowledged by the participants. The group also agreed that this was a necessary step in any efforts to provide equal opportunities for people.

C. RECOMMENDATIONS FOR KEEPING THE DOORS OPEN

Concurrent workgroup sessions were held so that conference participants could explore an issue important to them in some detail. Specific recommendations are included here.

1. Programs For Changing Times

The tension between the demands a high-tech economy has for new, advanced skills, and a rapidly changing workforce which has not had the education and training to develop these skills, requires the rapid development of innovative programs. Such programs must look at all aspects of curriculum development, pedagogical styles, support services, community participation in program design, and recruitment. To accomplish this, new relationships must be developed between schools, the workplace, community groups and parents.

Support systems must be institutionalized and opened up to everyone. Child care was traditionally provided by stay at home mothers and extended families. But with growing numbers of mothers returning to the workforce and increasing numbers of fathers sharing childcare responsibilities, child-care options near, or in the workplace or school are a necessity. Mentoring and job leads traditionally provided to the white male through personal networks have not been available for women and people of color because they lacked initial access to higher paying/higher skilled occupations. Such networks need to be built for everyone.

Key issues include: how to teach the skills that are needed with an approach that is learner-centered e.g. use of mentoring, team teaching, group learning; how to learn from existing programs that respect individuals for who they are, enhance self-esteem, motivate people to become employable and productive, and provide in-service training for program staff; and how to build programs that reach out in a positive way to parents to bring them into the educational process. A small group of teachers and curriculum development specialists should be brought together to prepare a series of workshops for teachers on these issues with an emphasis on learning from already existing "best practices".

2. Program Development and Evaluation

Effective program development requires knowledge of the language, culture, strengths, and problems affecting the populations the programs are being designed to serve. An evaluator can not

simply come in to learn about these issues. Involving members of the community in program design is central to acquiring this information.

It is often the case that federal, state and local agencies develop, implement and evaluate programs without ever talking to program users. Even though evaluations are considered objective exercises, there are many subjective steps involved in the process such as: decisions on questions to be asked and who to talk to; background of the evaluator and her/his knowledge of the culture and vernacular of the people being interviewed, and the crosscultural barriers which may block program success. To that end, evaluators should share the culture of the program's participants. If these issues are not taken into consideration program development and evaluation will be flawed

It is recommended that evaluation of programs begin during the early implementation stage so that effectiveness can be assessed and changes made before the program is over. In addition programs should be evaluated by all the participants. Feedback from students, teachers, and employers will strengthen any course being offered. At the same time an independent evaluation conducted during the program, not just at the end, can help to focus attention on plan weaknesses the organizers may not have seen. Corrective measures can be applied before the program is over and falls short of its intended objectives.

3. Management of a Multicultural Workforce And Classroom

The term multicultural generally refers to the cultures of people of different ethnic backgrounds. However people of the same ethnicity may in fact have different ways of thinking, acting and interrelating based on their life experiences as women, men, abled, disabled, rich or poor. The United States has advocated that everyone assimilate into one dominant culture. However, the assumption that "sameness" will lead to equality and progress has been proven false. Recognition of the positive value of diversity is a first step in effective management of a workforce/classroom. Awareness of the social cost of assimilation is essential if we are to establish a productive environment and stimulate the personal growth of workers and/or students. Respect for different cultures must be actively encouraged.

Assimilation robs people of their unique ways of expressing their knowledge and feelings and of relating to other people and situations. People of color who have been assimilated into the "mainstream" culture but are subsequently discriminated against because of race, have lost their own culture and are not accepted by their "adoptive culture", resulting in loss of values, low self-

esteem and performance, and marginalization. The society as a whole loses the richness that cultural diversity contributes to the value system and way of life.

Management must promote the strengths of multculturalism in the workplace/classroom. This can be done by providing the opportunity for information sharing within the organization. Trust building, a team approach, and creative solutions to problem solving are also essential. Businesses need to acknowledge that cultural differences do exist, but that all employees can successfully contribute to the organization. This applies to both the public and private sectors.

4. Recruitment, Hiring, Placement and Retention

Foremost in the development of recruitment, hiring, placement and retention strategies designed to open up an institution or workplace to traditionally excluded populations is the thorough examination of the barriers that prevent people from entering in the first place. Specific program ideas include:

1. Establish joint planning among education, industry and community officials to develop programs that prepare students for jobs in high technology career fields using a tiered approach. This will allow individuals to enter the workforce and continue their education over time, while still earning an income.

2. Draft specific written plans to help with the retention in training and education programs of women, people of color and linguistic minorities. Attention should be paid to the potential for instructor bias as classroom composition changes. Plans should cover such issues as the need to help trainees with study skills, and self-esteem.

3. Build teams of people who will work with clients to motivate them to look for jobs. Training programs should build job shadowing and mentoring into them so that clients are exposed to the work sites and employer expectations.

4. Encourage employers to open up all management and skilled positions to women, people of color, and linguistic minorities. This requires that firms and public agencies develop management training and skills development programs so that internal career ladders are built.

5. Effecting Policy Change

Policymakers set the broad guidelines that govern the development, implementation, and evaluation of education and training programs. Programs that fail to reflect the needs of the populations they are intended to serve will fall far short of their intended goals. Issues that need to be addressed through new policy formulation include:

1. The development of training programs that have support structures to provide attendance follow-up, personal counseling, bilingual skills instruction, math tutoring, shop visit, job shadowing, and mentorships.

2. The involvement of community-based organizations in all aspects of program development and recruitment. Establishing such relationships is time consuming but the long term results are worth the effort. Training institutions and community organizations and agencies are natural allies in any effort to provide high quality training to individuals who have been denied access to such programs. Policymakers should encourage such involvement in all training programs.

3. Staff training and support are needed to assist in the creation of dynamic classroom structures. Courses should be structured to allow skilled trainees to work in small groups with students who have lesser skills. The same approach works well when there are limited English proficient students in a classroom. For example, a limited English speaking student may have more technical skills than others in the class. By pairing that student with others with stronger language skills each learns quickly from the other. Stereotypes that tie 'intelligence' to language proficiency begin to be broken down. Students, by acting as instructors with each other, are empowered. This enhances self-esteem and provides trainees with important interpersonal skills they can use later on the job.

4. Employer workshops need to be developed to help them integrate their workers newly learned skills on the shop floor. Evidence shows that this does not occur on a regular basis. Employers are willing to support skills training for their employees and participate in new program and curriculum development efforts. Every effort should be made to involve employers in program development at the earliest possible stage. This will help insure that they are confident enough in a program to hire individuals from it, send their employees to it, and financially support it. During this collaboration steps should be taken to help employers develop strategies for successfully translating their workers new skills into job assignments. If this does not happen, skills will be forgotten and the cost effectiveness of programs will suffer dramatically.

6. Building Coalitions

Coalitions are built for a variety of reasons to meet specific objectives. A necessary element of coalition building is the development of a shared trust among all participants that the ends being sought will benefit everyone participating. In order to do this common ground must be established for everyone to work from. Issues coalitions could address include: the needs of people of color, linguistic minorities, and women in the work place; and the lack of communication between employers, employment bureaus, the educational sector and community agencies that represent these groups. Elements which facilitate and hinder this include:

Facilitate:	Hinder:
- Trust building - Participation of appropriate stakeholders - Clear written objectives - Long term process - Realistic objectives - Clear understanding of each others needs	- Not putting all of the cards on the table - Unclear purpose - No follow through - Absence of key groups/organizations - Lack of leadership from all group-concerned about an issue

Ethnic minority communities have been excluded from the decisionmaking process in the past. Inclusion means involving those who have been excluded through power sharing. For instance, training institutions could develop governing or leadership bodies that reflect the communities they are chartered to serve.

INDEPENDENT EVALUATION of

PROJECT CREATE

INDEPENDENT EVALUATION OF PROJECT CREATE

Final Report

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I. Overview

Project CREATE, a cooperative demonstration project funded by the U.S. Department of Education, was designed to develop a network, specific activities and resources that would provide quality education and support services to youth, currently employed adults, and women and minorities traditionally underrepresented in the high technology, high skill labor market.

The scope of project activities included in the mission of Project CREATE included training efforts, labor market research, the creation and facilitation of coordinated training agreements, development and implementation of recruitment and retention strategies, and information dissemination.

Ongoing evaluation of the project with regard to quality of service delivery and overall effectiveness was addressed internally by Project CREATE. External evaluation, for the purposes of routine monitoring of the project as well as methodological consultation and feedback, was provided by the University of Massachusetts' Donahue Institute for Governmental Services. This report presents the results of the independent evaluation effort designed to monitor the progress of Project CREATE in addressing the goals set forth in its grant.

II. Methodology

Monitoring of the grant activities conducted by Project CREATE was accomplished with a number of data collection strategies. First of all, the evaluators conducted ongoing review and analysis of all written documentation originating with the project. This review included any materials provided to the project's advisory board, as well as additional materials disseminated to the job training community. Additionally, a member of the evaluation team participated in a number of advisory board meetings as an observer.

Two on-site evaluation sessions were conducted, the first in October 1989 and the second in July 1990. In these meetings, the evaluators met with the staff of Project CREATE to gather in-depth information and review progress on all project components. A mid-cycle evaluation report was submitted following the interim session conducted in October.

Consultation and feedback on issues relevant to the internal evaluation efforts of the project which focused on quality of service and effectiveness took place in preliminary discussions with the evaluators at the beginning of the grant period, and during the mid-cycle evaluation session in October, 1989. Specific evaluation recommendations that evolved as a result of the mid-cycle discussions were included in the interim report.

Follow-up data regarding perceptions of the project's quality and overall impact were gathered toward the end of the grant period through a number of telephone interviews with advisory board members.

For the purposes of this report, the grant activity areas of Project CREATE have been organized into the following sections: 1) advisory board, 2) training, 3) research, 4) coordinated training agreements, 5) equity and recruitment, 6) job bank, and 7) product development and dissemination. As appropriate, the activity areas will be discussed in light of requirements set forth in the grant, grant requirements or project goals not met, and activities which exceeded grant requirements.

In terms of an overall perspective, the report summary will consider the merit of the project, relative to the goals of the grant. Where applicable, recommendations for areas of improvement will be presented, with emphasis on evaluation strategies for project monitoring and outcome evaluation.

III. Grant Activity Areas

1. *Advisory Board*

An Advisory Board for Project CREATE was assembled as an initial activity of the grant in March, 1989. The Advisory Board consisted of key individuals in the Greater Springfield and Holyoke area representing pubic and non-profit agencies, and private sector representatives from the industries addressed through grant activities. Board members served as committee members on three task forces: a) Coordinated Training Agreement, b) Conference Committee, and c) Skills Research. Several board members also served on a Race and Sex Equity Advisory Committee. In addition to attending monthly meetings, Advisory Board members assisted Project CREATE by providing feedback, access to information and resources, and other forms of ongoing support.

2. *Training Activities*

Project CREATE supported and/or implemented training activities in the following three fields of industry: 1) Machining, 2) Automotive repair, and 3) Printing. Training activities included entry-level skills acquisition for unemployed or unskilled persons, and skills upgrading for individuals currently employed.

In the machining area, two training programs were offered. The first was conducted at the Western Massachusetts Precision Institute (WMPI). The focus of this training was on basic machining skills including blueprint reading, shop math, shop theory and hands-on experience in the use of machining equipment. The second training program focused on computer numerical control (CNC). The program utilized curriculum materials developed with Project CREATE support, and was offered at Springfield Technical Community College (STCC).

For the automotive repair training, four programs were offered. These included two "Phase I" training sessions, designed to develop a fundamental understanding of automotive electronics. Phase II training efforts focused on "manufacturer specific" automotive computers. All automotive repair training programs were offered at Dean Vocational High School in Holyoke, MA.

Training sessions in the printing area were offered at Putnam Vocational High School. Two separate concurrent training sessions were offered – an introduction to

graphics technology for entry level participants, and a skills upgrade program for those currently employed in the printing industry. Curriculum for this training was provided by Putnam.

In terms of overall training provided by Project CREATE initiatives, the basic requirements of the grant were exceeded by the Project's training initiatives. The grant stipulated that four training sessions be offered, that 70 individuals must participate in training, and that the total number of training hours equal at least 741. Project CREATE offered eight training sessions to a total of 167 participants, and provided 1132 total hours of training time. Additional activities which exceeded the grant requirements included the use of evaluation techniques to assess pre-entry skills of participants and the use of post-training tests to measure the impact of training. In addition a portion of curriculum materials used in the training programs was translated from English to Spanish, to facilitate training for Spanish speaking participants.

In the seven programs completed at the time of this report[1], 146 persons entered training, with 107 successfully completing, representing an overall completion rate of 74%. The WMPI machining training, however, had a particularly high attrition rate, which was attributed by Project CREATE staff to the lack of adequate recruitment procedures on the part of WMPI. (see Section 5: Equity and Recruitment)

Additional areas of concern in training efforts involved the difficulty in maintaining adherence to the specified curriculum on the part of trainers affiliated with various academic institutions, as well as the lack of adequate hands-on training experiences. The CNC training program at STCC and the printing training offered at Putnam Vocational had difficulties in both these areas.

3. *Labor Market Research and Skills Assessment*

Labor market research, focused on the current job market, hiring trends and potential openings, was conducted in the early stages of the project, as a means of determining the areas of employment (in addition to machining) to be addressed through training efforts and coordinated training agreements. Through this research, automotive repair and printing emerged as the most appropriate labor market areas in need of skills

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[1] One of the "Phase II" automotive training programs began at the time this report was compiled, and therefore is not included in the analysis of completion rates.

enhancement and a trained labor pool in the region, particularly in light of rapidly changing technologies in these areas.

As a supplemental activity to the original proposed scope of the project, and as follow-up to the initial labor market research, skills assessment research was conducted in each of the three industries addressed through the project (machining, automotive and printing). The research consisted of an assessment of changing technologies in each of the three training areas, inventory of skills needed to perform duties required in the field, and determination of basic competencies (math skills, reading ability, problem solving, etc.) needed in these industries.

A subcommittee of the Project CREATE advisory board developed an interview guide which was used to interview 16 workers in each of the three industries. These interviews provided information regarding workers' perceptions of the current technology, the direction of trade in the future and the extent to which the worker feels prepared to meet changing technology in the field.

Based on information gathered from the interviews, a survey was developed by the research analyst and distributed to a sample of machine, printing and automotive shops in Hampden County. Seventy-five worker from each industry were selected to respond, although those individuals who actually responded may not have been representative of the industry as a whole.

Data from the survey were analyzed using multivariate and correlational statistical analysis. General results indicated that workers appear to know what technical skills will be necessary in the year 2000. However, workers do not feel they currently have sufficient training in math and reading to learn new technologies. In addition, the research found that the number of highly trained workers setting up computer-based equipment remains relatively low, although the use of such equipment continues to increase.

Results of the study were published in a report entitled What Do Workers Have to Say: Skills and Technological Change by Heitner, Forrant and Neveu (October, 1990), and disseminated through the National Center for Research in Education. Based on a review of the grant proposal, the labor market research, which was initially intended to be limited to the determination of appropriate training areas, clearly met and exceeded the basic requirements and expectations of the grant.

4. *Interagency Coordinated Training Agreements*

An Interagency Coordinated Training Agreement (CTA), designed to create a clear career ladder for the machining trade, was signed by representatives from private industry, state and local agencies and public higher education in May 1988. The agreement sought to provide trainees with a uniform curriculum across training programs, the opportunity to work toward apprenticeship papers, and college credit at Springfield Technical Community College toward a 2 year Associate's degree for participation in the training. In addition, the CTA states a clear mission toward the recruitment of women and people of color to training programs.

Implementation of the CTA in machining consisted of the development of training courses to be offered and dissemination of brochures (in English and Spanish) to roughly 2500 potential participants in the Hampden County area. In addition, workshops were conducted at vocational high schools to alert students of training opportunities available through the CTA.

A Coordinated Training Agreement for the printing industry was developed according to similar guidelines used for the CTA in Machining. The printing CTA was signed in March 1990.

In the Automotive Repair area no coordinated training agreement was signed. Project Create staff attribute this to a lack of integration in the automotive repair industry relative to manufacturer affiliation, and to the additional lack of a 2-year degree program in automotive technology at regional technical community colleges.

Difficulties encountered and addressed in the implementation process included the means for educating referral sources and case managers regarding opportunities stemming from the CTA, and for motivating shop owners to alert employees of resultant training opportunities. In general, the issue of marketing appears to be the most difficult element in securing successful implementation of an Interagency Coordinated Training Agreements.

5. *Equity and Recruitment*

Recruitment and retention for the training programs were addressed in a site-specific manner, which was a departure from the project's original goal of developing a single, broad based recruitment and retention strategy for all training programs. A survey

was designed by Project CREATE to collect data from each school/training institution to provide a profile of people enrolled in each program over a three year period. The results indicated that specific characteristics of each institution, the support resources available, instructor attitudes and participant demographics are all factors contributing to the need for site-specific strategy development.

In addition to the survey, an in-depth study of recruitment and retention strategies was conducted for the Western Massachusetts Precision Institute (WMPI), where recruitment of women and minorities was perceived as problematic throughout the Institute's history.

Information regarding recruitment and equity issues was presented by Project Create in a conference held in May, 1990. The conference, entitled "Opening Doors in the Nineties: Workers, Skills and Diversity", was attended by approximately 150 individuals. In addition, Project CREATE staff developed a video presentation on equity and access issues.

In its recruitment efforts for the various project-supported training programs, Project CREATE proactively sought women and persons of color to fill training openings. Attempts to recruit were initially hampered by the lack of well established referral networks. Over the course of the project and as a result of project recruitment efforts, however, such networks have certainly begun to emerge.

6. *Job Bank*

The job bank represents an aspect of the grant proposal that was not realized during the grant cycle. Working through the Machine Action Project (MAP), project staff hoped to develop a computer-based network connecting dislocated machinists with machine shops in need of skilled workers. Initial efforts in setting up the job bank were hampered by the loss of critical computer equipment.

7. ***Product Development and Dissemination***

A. **ACCESS Newsletter**

"ACCESS" is a quarterly newsletter produced by Project CREATE staff to inform the advisory board, state and local agencies, members of industry and other interested

parties in the private sector about the progress of Project CREATE activities. While not an original part of grant activities, the ACCESS newsletter provided a mechanism for disseminating information gathered by the project and for alerting agencies and companies in the three target industries of training opportunities created by the project. "ACCESS" is currently distributed to 700 recipients across the country.

B. Equity/Access Videotape

Although originally conceptualized as an overview of project activities, the videotape presentation evolved into a documentary regarding access and equity issues in technical training in the Hampden County area. The program includes interviews with educators, community leaders, and trainees. It has been used and will continue to serve as a tool in the development of educational workshops.

C. Project Conference

The project conference, entitled "Opening Doors in the Nineties", originally scheduled for August, was moved to May 1990. A committee of Project CREATE advisory board members met regularly to plan the conference. As noted above, approximately 150 people from the western Massachusetts region, largely from social service agencies, vocational and technical schools, and governmental agencies involved in training, participated in the day long conference. The conference included information on vocational education and training, the changing nature of the work force, and the creation of opportunities for women and minorities in "traditional" fields. In addition, the conference provided an opportunity to disseminate information and knowledge gained during the course of the project.

IV. Report Summary

1. *Project Limitations*

Addressing the overall impact of the project, there is some utility in first examining difficulties or limitations the project encountered during the grant cycle. Several unexpected issues developed as a result of differences between Project CREATE and individual training institutions regarding goals for recruitment and curriculum presentation. CREATE staff placed the recruitment of women and persons of color as a major goal of the project. At several training sessions offered, the low numbers of women and people of color was directly attributed by CREATE staff to the recruitment stance of the training institution were the training was offered.

In addition to differences in recruitment goals, other difficulties with training institutions concerned the delivery of curriculum. Particularly with respect to the provision of hands-on training, there were some discrepancies between curriculum outlined by Project CREATE and the curriculum which was actually delivered to trainees.

During the grant cycle, CREATE staff conducted regular evaluations of training sessions, employing pre-post skills evaluations and participant evaluation questionnaires to assess the program's efficacy. CREATE staff felt, however, that more systematic evaluation procedures could have been developed, or should have been provided by the Department of Education. Systematic tracking and monitoring of training participants on such variables as wage scale, applicability of training skills in work settings, and job retention rates would be useful, toward the establishment of baseline data for longitudinal assessment. In addition, standardized evaluation methods could have provided additional data allowing comparisons among training programs and institutions.

In the development of a recruitment and retention strategy, Project CREATE staff found that the multifaceted nature of these issues does not facilitate a simple, generalizable solution or single list of steps to effect adequate recruitment and retention of training participants. In fact, it was necessary to abandon the original goal of a single strategy, and work toward the development of institution-specific strategies. As a part of successful recruitment and retention, CREATE staff also perceived a need for more institutional support for non-English speaking trainees, including bilingual training instructors and/or the provision of English as a Second Language (ESL) trainers on-site during training sessions to assist this population.

Finally, the CREATE staff reported that there was an inherent difficulty in attempting to provide highly skilled, technologically advanced training to a non-traditional target population, in that so few women and people of color are currently involved in the target industries at even basic skill levels. Given this limitation, CREATE staff restructured training to provide more basic skills courses first, to be followed by the higher skills training.

2. *Value and Role of the Project*

Project CREATE's role within the broad job training community during its grant activities was primarily as a leadership and coordinating agency for delivery of training services. This role was established through the identification of goals for private industry, the labor pool on both group and individual levels, and training institutions. CREATE attempted to find areas of overlapping interest and worked toward joining these interests. An excellent example of such overlap is the development of Coordinated Training Agreements (CTAs). In addition, CREATE staff also focused on the unique interests of these various groups, attempting to assist in specific areas, such as recruitment strategies at various training institutions.

At the agency level, CREATE worked closely with community based organizations that were involved with target training populations, in order to mobilize information networks among potential trainees and to coordinate agency efforts throughout the county with respect to training. Working with target industries revolved, to a large extent, around the development of methods to engage them in the training process: 1) in collaborative efforts toward designing the training, and 2) in following up on people they sent to training, namely by increasing wages to meet new skills and/or upgrading the individual's position so that the newly acquired skills are used. Finally, CREATE staff members worked with training institutions to ensure better service to women, people of color, and linguistic minorities. Primary areas of focus included the development of more equitable recruitment strategies, incorporation of ESL into training, and development of support services such as day care at the institution.

In viewing the overall impact of Project CREATE, what emerges is the potential utility of the project's structure as a model for a community based institution which coordinates and provides leadership in the area of vocational training. While the project provided training opportunities to underserved populations, the training was not provided by the project, but rather by training institutions in the area. To the extent that Project

CREATE was able to engage the private sector and coordinate relevant social service agencies in the training and recruitment process, it had the advantage of a relatively objective position. Evidence of this leadership role and coordinating position is seen in the development of the Coordinated Training Agreements.

Given the time-limited nature of the project, the impact of a long standing institution functioning in a manner similar to Project CREATE is somewhat difficult to assess. A major benefit of a permanent organization would be increased impact on the entire training delivery system, including training institutions, social service agencies and industries. More influence could be brought to bear on recruitment policy and curriculum delivery at training institutions if the coordinating agency could be selective, on a long term basis, in choosing which training institutions would be funded. In addition, a permanent coordinating body such as Project CREATE would have influence on the development of information networks in the labor pool, with the potential to better provide underserved populations with information about training opportunities.

Beyond the project's value as a model for a coordinating agency in vocational training, Project CREATE created several products which provide potential benefits not only to the training efforts in the Hampden County area, but also for national efforts toward vocational training. The first of these is the compilation of new curriculum materials in the automotive, printing and machining industries that did not exist before, some of which has been translated to Spanish. These curriculum advances could be used as a model for other vocational training curriculums, and could also be expanded toward a comprehensive training curriculum in each of these industries.

The second product which has benefits beyond the scope of the project is the collection of skills research conducted within the context of the grant. The results and conclusions drawn from this research effort had a direct impact on provision of training during the grant cycle, but the findings have relevance to other regions and other industries, particularly when considered at the broadest level. Conclusions from the research indicating an expanding gap between a few highly skilled workers with knowledge of computer numerical control in machining and the general population of machinists with traditional metal-working skills can potentially be generalized to other regions and other industries. The implications of the research warrant consideration for future program development and curriculum design in vocational education.

Additional benefits of Project CREATE's initiatives include the impact on local vocational-technical trainers, who were able to update and upgrade both curriculum materials and training methods as a result. Also, the project was able to enhance the role of the private sector in public sector training efforts. Private sector involvement ranged from representation and input on the project's advisory board, to the donation of critical training materials, such as used equipment and automobiles. Finally, public sector agencies, both governmental and community-based, have to some degree also been impacted by the project. Project staff reported a marked change in the receptivity of such agencies to the fundamental ideas promoted by the project, most importantly the awareness of the value and importance of promoting job training in placement strategies for clients, rather than simply limiting their efforts to the location of specific jobs.

Although Project CREATE had a positive impact on vocational training in the Hampden County area, several questions have been raised by the project's staff, and are worthy of consideration as future foci for research and program development.

- When skills upgrading training is provided, what happens when trainees go back to work? What is the overall impact on the work force, the company, the trainee?
- What are implications of change in the work force, where high tech skills become increasingly needed, but fewer individuals are trained in these areas?
- What new strategies can be developed to secure vocational training opportunities for women and linguistic minorities? How can time-limited grant-funded projects impact access and equity issues in training institutions, social service agencies, and private industry?

Overall, Project CREATE can be considered a highly positive and beneficial contribution to vocational training on both the regional and national levels. On the regional level, the project provided much needed training to individuals in the printing, automotive repair and machining industries. From the perspective of its impact at the national level, the CREATE grant produced new curriculum and research, and most significantly, provided a model for an institution which provides leadership, research, monitoring and coordination in vocational training efforts.

Springfield Technical Community College

Center for Business/Industry Development

Curriculum for Computerized Numerical Control Repair

Sponsored by

PROJECT CREATE

Hampden County Employment

and Training Consortium

SPRINGFIELD TECHNICAL COMMUNITY COLLEGE
ONE ARMORY SQUARE
SPRINGFIELD MASSACHUSETTS

CNC REPAIR TECHNOLOGY

(PROPOSED)

COURSE	TITLE	CLASS	LAB	CREDIT
	SEMESTER I			
MM 132	TECHNICAL MATH I	4	0	4
LE 100	ENGLISH COMPOSITION I	3	0	3
ED 240	PROGRAMMING FOR MICROCOMPUTERS	1	3	2
EE 110	BASIC ELECTRICITY I	2	3	3
	MACHINING FUNDAMENTALS	2	3	3
		13	9	15
	SEMESTER 2			
EE 210	BASIC ELECTRICITY II	2	3	3
EE 240	FUNDAMENTALS OF MOTOR CONTROL	1	3	2
EE 330	SEMI/TRANSISTORS	2	3	3
FB 235	INTRO TO CNC	2	3	3
LE 202	TECHNICAL REPORT WRITING	3	0	3
MP 119	TECHNICAL PHYSICS	3	3	4
		13	15	18
	SEMESTER 3			
NEW	DIGITAL ELECTRONICS	2	3	3
FB 420	FLUID POWER	3	0	3
FA 335	COMPUTER AIDED MANUFACTURING	2	6	4
EE 320	INDUSTRIAL ELECTRONICS	2	3	3
EE 350	PROGRAMMABLE MOTOR CONTROLS	2	3	3
	MECHANISMS/KINEMATICS	3	0	3
		14	15	19
	SEMESTER 4			
LE 203	FUNDAMENTALS OF SPEECH	3	0	3
ET	MICROPROCESSOR APPLICATIONS	2	3	3
EE 441	INDUSTRIAL OP-AMPS	2	3	3
	TROUBLESHOOTING LAB	1	3	2
NP 109	HUMAN RELATIONS AT WORK	3	0	3
	SOC. SCI./HUMANITIES ELECTIVE	3	0	3
		14	9	17

69 CREDITS

CNC MACHINE REPAIR TECHNOLOGY

(CURRICULUM DEVELOPMENT)

COURSE: EE 110 - BASIC ELECTRICITY I

DESCRIPTION:

THIS COURSE IS FOR BEGINNING STUDENTS WITHOUT ANY EXPERIENCE IN ELECTRICITY AND ELECTRONICS. THE MATERIAL INCLUDES DIRECT CURRENT FUNDAMENTALS AND LABORATORY FUNDAMENTALS AS RELATED TO DC ELECTRIC CIRCUITS. SOME OF THE TOPICS COVERED ARE OHM'S LAW SERIES AND PARALLEL DC CIRCUITS, METERS, RESISTANCE, THEVININ'S THEOREM, KIRCHOFF'S LAWS AND SUPERPOSITION. THE COURSE ASSUMES NO PREVIOUS KNOWLEDGE OF ELECTRICITY OR ELECTRONICS. ONLY A BASIC UNDERSTANDING OF ALGEBRA IS REQUIRED. (MINIMUM MATH RECOMMENDED TO TAKE THIS COURSE IS MM 087 COMPLETED).

TEXT:

ELECTRONICS FUNDAMENTALS CIRCUITS AND DEVICES BY JOEL GOLDBERG. PRENTICE-HALL

EE 110 BASIC ELECTRICITY I

LECTURE	CHAPTER	TOPIC
1	1	INTRODUCTION
2-3	2-3	NATURE OF ELECTRICITY
4-5	4-5	CIRCUIT LAWS
6	1-5 1-5	REVIEW
8-9	6	SERIES CIRCUITS
10-11	7	PARALLEL CIRCUITS
12	6-7	REVIEW
13	6-7	
14-15	8	PARALLEL AND SERIES CIRCUITS
16-17	8	MORE CIRCUITS
18	8	REVIEW
19		
20-21	10	KIRCHKOFF'S LAW
22-23	11	NETWORK THEOREMS
25	10-11	
26	12	DC METERS
27	1-12	

CNC MACHINE REPAIR TECHNOLOGY

(CURRICULUM DEVELOPMENT)

COURSE: EE 210 - BASIC ELECTRICITY II

DESCRIPTION:

THIS COURSE IS FOR BEGINNING STUDENTS WITH A BACKGROUND IN FUNDAMENTALS OF ELECTRICITY. THE MATERIAL INCLUDES ALTERNATING CURRENT FUNDAMENTALS AND LABORATORY FUNDAMENTALS AS RELATED TO AC ELECTRIC CIRCUITS. SOME OF THE TOPICS COVERED ARE OHM'S LAW, SERIES AND PARALLEL AC CIRCUITS, METERS, RESISTANCE, THEVENIN'S THEOREM, KIRCHOFF'S LAWS AND THE AC SUPERPOSITION THEOREM.

TEXT:

ELECTRONICS FUNDAMENTALS CIRCUIT AND DEVICES. BY JOEL GOLDBERG - PRENTICE HALL

EE 210 BASIC ELECTRICITY II

CHAPTER	TOPIC
1	MAGNETISM
2	MAGNETIC UNITS
3	INDUCTANCE
4	ALTERNATING CURRENT AND VOLTAGE
5	60-HZ AC POWER
6	TRANSFORMERS
7	INDUCTIVE REACTANCE
8	INDUCTIVE CIRCUITS
9	MORE INDUCTIVE CIRCUITS
10	CAPACITANCE
11	CAPACITIVE REACTANCE CAPACTIVE CIRCUITS
12	CAPACITIVE CIRCUITS
13	RC AND L/R TIME CIRCUITS
14	AC CIRCUITS
15	THE J OPERATOR AND COMPLEX NUMBERS
16	AC NET WORK ANALYSIS
17	RESONANCE

CNC MACHINE REPAIR TECHNOLOGY

(CURRICULUM DEVELOPMENT)

COURSE: EE 140-01 BASIC PROGRAMMING FOR MICROCOMPUTERS

DESCRIPTION:

THIS IS AN INTRODUCTORY COURSE REQUIRING NO PREVIOUS KNOWLEDGE OF MICROCOMPUTERS. THIS COURSE CONTAINS TWO DISTINCT TOPICS ON MICROCOMPUTERS. THE FIRST IS MICRO-COMPUTER FUNDAMENTALS AND THE SECOND IS BASIC PRO-GRAMMING. THE FUNDAMENTALS COMPONENT WILL INCLUDE THE COMPONENTS OF A MICROCOMPUTER SYSTEM, ITS OPERATION AND HARDWARE STRUCTURE. THE PROGRAMMING COMPONENT IS DESIGNED TO DEVELOP KNOWLEDGE RELATED TO THE PROCESSES INVOLVED IN THE CREATION OF USEFUL SOFTWARE FOR SYSTEMS AND RELATED HARDWARE.

TEXT:

BASIC FOR ELECTRONICS BY ROBERT R. SILVA, DELMAR, 1986.

SUGGESTED REFERENCE TEXTS:

COMMODORE 128 PROGRAMMING SECRETS BY WILLIAM M. WIESE JR., MCGRAW-HILL, 1986.

EE 140 BASIC PROG.

CHAPTER	TOPIC
1	INTRODUCTION - COURSE OBJECTIVES.
2	INTRO TO COMPUTERS.
3	COMPUTER ARCHITECTURE.
4	COMPUTER PERIPHERALS.
5	INTRODUCTION TO PROGRAMMING 2. - 2.9.
6	PROGRAMMING CONTINUED 2.10 - 2.17.
7	BRANCHING 3.1 - 3.3.
8	BRANCHING CONTINUED 3.4 & 3.5.
9	PROGRAM LOOPS 4.1 & 4.2.
10	PROGRAM LOOPS CONTINUED 4.3 & 4.4.
11	ARRAYS FOR ELECTRONICS 5.1 AND 5.2.
12	ARRAYS CONTINUED 5.3 AND 5.4.
13	ARRAYS CONTINUED 5.5 & 5.6.
14	FUNCTIONS FOR ELECTRONICS.
15	FUNCTIONS FOR ELECTRONICS CONTINUED.
16	FUNCTIONS FOR ELECTRONICS CONTINUED.
17	DIGITAL LOGIC GATES.
18	DIGITAL LOGIC GATES.
19	DIGITAL LOGIC GATES.
20	DIGITAL LOGIC GATES.
21	ADVANCED ELECTRONICS PROGRAMS.
22	ADVANCED ELECTRONICS PROGRAMS.
23	ADVANCED ELECTRONICS PROGRAMS.
24	FINAL PROGRAM ASSIGNMENT

CNC MACHINE REPAIR TECHNOLOGY

(CURRICULUM DEVELOPMENT)

COURSE: EE 330-61 - SEMICONDUCTORS & TRANSISTORS I

DESCRIPTION:

THE PRINCIPLES AND ELECTRICAL PROPERTIES OF SEMICONDUCTOR DIODES AND TRANSISTORS ARE STUDIED. SPECIAL EMPHASIS IS PLACED UPON THE USES OF SEMICONDUCTOR DEVICES IN RECTIFIERS, AMPLIFIERS, OSCILLATORS AND SPECIAL CIRCUITS. THE ACCOMPANYING LABORATORY WORK ENABLES THE STUDENT TO MEASURE THE PROPERTIES OF THESE DEVICES AND TO VERIFY THEIR OPERATING PRINCIPLES AND USES IN ACTUAL CIRCUITS.

TEXT:

ELECTRONIC PRINCIPLES BY ALBERT PAUL MALVINO, PH.D.
FOURTH EDITION, MCGRAW-HILL BOOK COMPANY.

EXPERIMENTS FOR ELECTRONIC PRINCIPLES BY ALBERT PAUL MALVINO, PH.D., FOURTH EDITION, MCGRAW-HILL BOOK CO.

EE 330 SEMICONDUCTORS AND TRANSISTORS I

WEEK	CHAPTER	TOPIC
1	1	INTRODUCTION - CONVENTIONAL CURRENT AND ELECTRON FLOW
2	1	VOLTAGE AND CURRENT SOURCES
2	1	THEVENIN'S THEOREM
2	1	NORTON'S THEOREM
3	2	DIODE THEORY - CONDUCTION IN CRYSTALS/ DOPING
3	2	DIODE BIASING
3	3	LINEAR DEVICES - GRAPH, LOAD LINE
3	3	DIODE APPROXIMATIONS - DC RESISTANCE
4	4	DIODE CIRCUITS - SINEWAVE, TRANSFORMER
4	4	RECTIFICATION - 1/2, FULL, BRIDGE
5	4	CAPACITANCE - INPUT FILTERS
6	4	MULTIPLIERS, LIMITER, CLAMPER, P-P DETECTOR AND DC RETURN
7	1-4	
8	5	ZENER DIODE (REGULATOR)
8	5	OPTOELECTRONIC DEVICES
8	5	SCHOTTKY DIODE, VARACTOR, MISC.
9	6	BIPOLAR TRANSISTORS
9	6	FORWARD/REVERSE BIAS
9	6	CE CONNECTION, CHARACTERISTICS
10	7	DC LOAD LINE, TRANSISTOR SWITCH
10	7	CURRENT SOURCE
10	7	OPTOELECTRONIC DEVICES, TROUBLESHOOTING, DESCRETE/INTEGRATED CKTS
11	5-7	
12	8	TRANSISTOR BIASING, BASE BIAS
12	8	EMITTER-FEEDBACK, COLLECTOR-FEEDBACK BIAS
13	8	VOLTAGE DIVIDER & EMITTER BIAS
14	8	MOVING GROUND AND PNP CKTS

CNC MACHINE REPAIR TECHNOLOGY

(CURRICULUM DEVELOPMENT)

COURSE: EE 240-01 - FUNDAMENTALS OF MOTOR CONTROLS

DESCRIPTION:

THIS COURSE IS AN INTRODUCTION TO MOTOR CONTROLS IN INDUSTRIAL ELECTRONICS. THE INTENT IS TO DEVELOP SAFE AND COMPETENT USE OF TOOLS AND RELATED COMPONENTS IN CONSTRUCTION OF INDUSTRIAL CIRCUITS. IT STRESSES THE BASICS OF COMPONENT OPERATION, CONNECTION AND APPLICATION. THE STUDENT IS INTRODUCED TO BASIC LINE AND WIRING DIAGRAMS AND SYMBOLS WHICH LEAD TO SUCH TOPICS AS PROGRAMMABLE CONTROLS AND AUTOMATED SYSTEMS. TROUBLESHOOTING AND THE USES OF VARIOUS TYPES OF ELECTRONIC TEST EQUIPMENT IS ALSO COVERED.

TEXT:

ELECTRICAL MOTOR CONTROLS/AUTOMATED INDUSTRIAL SYSTEMS BY GARY ROCKIS AND GLEN MAZUR, 2ND ED., AMERICAN TECHNICAL PUBLISHERS.

WORKBOOK FOR ELECTRICAL MOTOR CONTROLS BY GARY ROCKIS AND GLEN MAZUR, 2ND ED., AMERICAN TECHNICAL

CLASS SCHEDULE EE 240 - MOTOR CONTROLS

LECTURE	CHAPTER	TOPIC
1		INTRODUCTION - COURSE OBJECTIVES/SAFETY
2	2	INDUSTRIAL ELECTRICAL SYMBOLS
3	2	LINE DIAGRAMS
4	3	LOGIC
5	3	LOGIC APPLICATION TO LINE DIAGRAMS
6	4	AC MANUAL CONTACTORS
7	4	MOTOR STARTERS
8	5	MAGNETISM AND MAGNETIC SOLENOIDS
9	6	AC/DC CONTACTORS
10	6	MAGNETIC MOTOR STARTERS
11	7	TIME DELAYS
12	7	TIME DELAYS AND COMPLEX LINE DIAGRAMS
13		REVIEW OF COURSE TO DATE
14	8	CONTROL DEVICES
15	9	REVERSING CIRCUITS
16	10	POWER DISTRIBUTION SYSTEMS
17	10	SWITCHBOARDS AND PANELS
18	11	SOLID STATE ELECTRONIC CONTROL
19	11	SOLID STATE CONTROL DEVICES
20	12	ELECTROMECHANICAL RELAYS
21	12	SOLID STATE RELAYS
22		REVIEW ON COURSE TO DATE
23	13	PHOTOELECTRIC CONTROL
24	13	PROXIMITY CONTROL
25	13	PROXIMITY & PHOTOELECTRIC APPLICATIONS
26	14	PROGRAMMABLE CONTROLS
27	14	USES FOR PROGRAMMABLE CONTROLS
28	14	APPLICATIONS AND CONTROL STRATEGIES
29	14	PROGRAMMING A PLC
30		REVIEW OF COURSE TO DATE

CNC MACHINE REPAIR TECHNOLOGY

(CURRICULUM DEVELOPMENT)

COURSE: EE 320 - INDUSTRIAL ELECTRONICS

DESCRIPTION:

THE SYSTEMS AND DEVICES WHICH ARE STUDIED REPRESENT A BROAD RANGE OF INDUSTRIAL APPLICATION. THE BASIC CIRCUITS AND SYSTEMS USED TO ILLUSTRATE THE IDEAS UNDER DISCUSSION ARE INVARIABLY TAKEN FROM REAL-LIFE INDUSTRIAL SITUATIONS. EMPHASIS IS PLACED ON THE CHARACTERISTICS OF THE TRANSISTOR SWITCH, SCR, UJT AND TRIACS AS WELL AS DIGITAL DEVICES.

TEXT:

INDUSTRIAL SOLID-STATE ELECTRONICS DEVICES AND SYSTEMS
SECOND EDITION BY TIMOTHY J. MALONEY
PRENTICE-HALL

EE 320 INDUSTRIAL ELECTRONICS I

LECTURE	CHAPTER	TOPIC
1		INTRODUCTION
2-3	1	THE TRANSISTOR SWITCH
4-5	1	SOLID STATE LOGIC
6	1	REVIEW
7	1	HOUR TEST
8-9	2	TRANSISTOR SWITCH APPLICATIONS
10-11	2	TIMERS
12	2	REVIEW
13	2	HOUR TEST
14-15	4	SCR THEORY
15-16	4	SCR APPLICATION
17	4	REVIEW
18	4	HOUR TEST
19-20	5	UJT THEORY
21-22	5	UJT APPLICATION
23	5	REVIEW
24	5	HOUR TEST
25-26	6	TRIACS AND OTHER THYRISTORS THEORY
27-28	6	TRIAC APPLICATION
29	6	REVIEW
30	6	HOUR TEST

CNC MACHINE REPAIR TECHNOLOGY

(CURRICULUM DEVELOPMENT)

COURSE: EE 441 - INDUSTRIAL OP-AMPS

DESCRIPTION:

THE PRIMARY EMPHASIS THROUGHOUT THIS COURSE IS TO DEVELOP THE STUDENTS FACILITY FOR ANALYZING VARIOUS CIRCUIT FUNCTION, RATHER THAN ON SIMPLY PRESENTING A ROTE COLLECTION OF EXISTING CIRCUITS OR SHOWING NUMEROUS WIRING DIAGRAMS FOR SPECIALIZED INTEGRATED CIRCUIT MODULES. THIS ESTABLISHES A FOUNDATION FOR UNDERSTANDING NEW DEVELOPMENTS AS THEY ARISE. SINCE NEW DEVICES ARE CONSTANTLY APPEARING ON THE MARKET, THE COURSE WILL COVER A FEW DEVICES IN DETAIL. THE BEST WAY TO ADAPT TO A NEW TECHNOLOGY IS TO HAVE A FIRM GRASP OF THE BASIC PRINCIPLES. THIS COURSE HAS BEEN ORGANIZED TOWARD THAT GOAL.

TEXT:

INDUSTRIAL SOLID-STATE ELECTRONICS DEVICES & SYSTEMS.
2ND EDITION - BY TIMOTHY J. MALONEY. PRENTICE-HALL

CLASS SCHEDULE EE 441 INDUSTRIAL OP-AMPS

LECTURE #	CHAPTER	TOPIC
1	1	INTRODUCTION - COURSE OBJECTIVES.
2	1	DIFFERENTIAL AMPLIFIERS.
3	1	CHAPTER SUMMARY.
4	2	THE IDEAL OP AMP.
5	2	BASIC OP AMP CIRCUITS.
6	2	HYBRID ICS.
7	2	CHAPTER SUMMARY.
8	3	REAL OP AMPS.
9	3	BIAS CURRENT AND OFFSET.
10	3	FREQUENCY RESPONSE.
11	3	NOISE AND OP AMPS.
12	3	CHAPTER SUMMARY.
13	4	SPECIFICATION SHEETS.
14	4	OP AMP DESIGNS.
15	4	SINGLE-SUPPLY OPERATION.
16	4	CHAPTER SUMMARY.
17	5	HEAT DISSIPATION CONSIDERATIONS.
18	5	INTERFACING OP AMPS.
19	5	HIGH CURRENT/VOLTAGE APPLICATIONS.
20	5	CHAPTER SUMMARY.
21	6	VOLTAGE REGULATORS.
22	6	POWER SUPPLY DESIGN.
23	6	THREE-TERMINAL REGULATORS.
24	6	CHAPTER SUMMARY.
25	7	ACTIVE FILTERS.
26	7	TYPES OF FILTERS.
27	7	FREQUENCY RESPONSES.
28	7	OPERATION CHARACTERISTICS.
29	7	CHAPTER SUMMARY.

SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

DIVISION OF ENGINEERING TECHNOLOGIES

DEPARTMENT: ELECTRONICS TECHNOLOGY DATE: AUGUST, 1989

COURSE NUMBER: SEMESTER CREDITS: 3

COURSE TITLE: DIGITAL ELECTRONICS PROFESSOR: G. MULLETT

COURSE DESCRIPTION:

THIS COURSE CONSISTS OF A COMPREHENSIVE STUDY OF DIGITAL ELECTRONICS. AFTER A BRIEF INTRODUCTION TO THE DIGITAL WORLD, THE CONCEPTS OF MICROPROCESSOR NUMBER SYSTEMS AND COMPUTER CODES ARE TREATED. THE BASIC BUILDING BLOCKS OF DIGITAL ELECTRONICS -- LOGIC GATES -- ARE STUDIED NEXT. THE USE OF BOOLEAN ALGEBRA FOR BOTH LOGIC ANALYSIS AND SIMPLIFICATION OF LOGIC CIRCUITS IS EXAMINED AND THE ANALYSIS AND DESIGN OF SIMPLE COMBINATIONAL NETWORKS IS COVERED. WITH THE FUNDAMENTALS NOW WELL COVERED, ATTENTION SHIFTS TO MORE ADVANCED LOGIC COMPONENTS -- PROGRAMMABLE LOGIC ARRAYS, MULTIPLEXERS AND DEMULTIPLEXERS, ENCODERS AND DECODERS, LATCHES AND FLIP-FLOPS, COUNTERS AND REGISTERS, MEMORIES AND CONVERSION DEVICES, AND FINALLY MICROPROCESSORS AND INTERFACING COMPONENTS.

THE LABORATORY WORK ALLOWS THE STUDENT TO VERIFY THE THEORY AND OPERATION OF VARIOUS DIGITAL CIRCUITS AND SYSTEMS MENTIONED IN CLASS. ALSO, UTILIZING PROTO-BOARDS THE STUDENT IS ABLE TO CONSTRUCT SEVERAL SIMPLE CIRCUITS AND SYSTEMS USING THE THEORY SET FORTH IN THE COURSE.

CATALOG DESCRIPTION:

THIS COURSE IS AN INTRODUCTION TO THE CONCEPTS OF DIGITAL ELECTRONICS. COVERAGE INCLUDES: COMPUTER MATHEMATICS, BOOLEAN ALGEBRA, LOGIC AND LOGIC SYSTEMS. THE AIM OF THE COURSE IS TO PRESENT THE NECESSARY INFORMATION ESSENTIAL TO THE UNDERSTANDING OF DIGITAL ELECTRONICS SYSTEMS, MICROPROCESSORS, AND NUMERIC CONTROL SYSTEMS.

PREREQUISITES:

BASIC ELECTRONICS THEORY

COURSE PURPOSE:

TO INTRODUCE THE STUDENT TO THE FUNDAMENTAL CONCEPTS OF DIGITAL ELECTRONICS. TO ACCOMPLISH THIS GOAL, THE STUDENT IS ACQUAINTED WITH THE BASICS OF COMPUTER MATHEMATICS, THE FUNDAMENTALS OF LOGIC GATES, AND THE THEORY OF LOGIC SYSTEMS.

COURSE OBJECTIVES:

1. TO BECOME FAMILIAR WITH THE POSSIBLE APPLICATIONS OF DIGITAL ELECTRONICS AND GATING NETWORKS.
2. TO BECOME FAMILIAR WITH THE NOTIONS OF DIGITAL INFORMATION REPRESENTATION AND DIGITAL ARITHMETIC.
3. TO BECOME PROFICIENT IN THE UNDERSTANDING OF COMBINATIONAL LOGIC AND NETWORK REPRESENTATION.
4. TO BECOME FAMILIAR WITH THE THEORY OF BOOLEAN ALGEBRA AND ITS USE AS A SWITCHING ALGEBRA.
5. TO ACQUAINT THE STUDENT TO THE IDEAS OF LOGIC NETWORK REALIZATION AND MINIMIZATION TECHNIQUES USING BOOLEAN ALGEBRA.
6. TO BECOME FAMILIAR WITH PRESENT DAY LOGIC FAMILIES.
7. TO BECOME FAMILIAR WITH THE MORE ADVANCED LOGIC COMPONENTS: PLA'S, MULTIPLEXERS AND DEMULTIPLEXERS, ENCODERS AND DECODERS, LATCHES AND FLIP-FLOPS, COUNTERS AND REGISTERS, MEMORIES AND CONVERSION DEVICES, AND MICROPROCESSORS.

COURSE OUTLINE:

1. INTRODUCTION TO DIGITAL ELECTRONICS
   A. THE DIGITAL WORLD
   B. MICROPROCESSOR APPLICATIONS
   C. ELECTRONIC APPLICATIONS

2. DIGITAL INFORMATION AND DIGITAL ARITHMETIC
   A. NUMBER SYSTEMS
   B. CONVERSION TO OTHER NUMBER SYSTEMS
   C. REPRESENTATION OF INFORMATION

3. CODES
   A. BCD
   B. ALPHANUMERIC
   C. PARITY CHECKING

4. BOOLEAN ALGEBRA
   A. BOOLEAN CONCEPTS
   B. BASIC LOGIC GATES
   C. COMBINATIONAL LOGIC
   D. BOOLEAN THEOREMS
   E. BOOLEAN EXPRESSIONS

5. GATING NETWORKS
   A. NETWORK REALIZATION
   B. NETWORK MINIMIZATIONS
      1. THEOREMS
      2. MAPS
   C. MISCELLANEOUS REALIZATIONS

6. BIPOLAR LOGIC GATES
   A. SEMICONDUCTOR DEVICES
   B. LOGIC TYPES
      1. TRADITIONAL
      2. STATE-OF-THE-ART LOGIC
         A. TTL
         B. ECL 10000
         C. I SQUARED L
         D. CCD

7. MOS LOGIC GATES
   A. CMOS THEORY
   B. MOS INVERTER
   C. NAND AND NOR GATES
   D. TYPES OF GATES
      1. STATIC
      2. DYNAMIC

8. FAMILIARIZATION WITH PRESENT DAY 7400 SERIES TTL LOGIC

9. PROGRAMMABLE LOGIC DEVICES
   A. ADDERS
   B. COMPARATORS
   C. DECODERS
   D. ENCODERS
   E. MULTIPLEXERS
   F. DEMULTIPLEXERS

10. FLIP-FLOPS
    A. THE APPLICATIONS OF FLIP-FLOPS
    B. THE LAW OF OPERATION
    C. [illegible]

11. COUNTERS
    A. ASYNCHRONOUS COUNTERS
    B. SYNCHRONOUS COUNTERS
    C. UP/DOWN

12. SHIFT REGISTERS

13. MEMORIES

14. CONVERSION DEVICES

15. MICROPROCESSORS

16. INTERFACING DEVICES

TEXT AND SUPPLEMENTARY MATERIALS:

"DIGITAL", BY THOMAS ADAMSON DELMAR

"DIGITAL ELECTRONICS" BY JOHN KERSHAW PWS-KENT

"DIGITAL ELECTRONICS" BY M. FORBES AND B. BREY BOBBS-MERRILL

SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

DIVISION OF ENGINEERING TECHNOLOGIES

DEPARTMENT: ELECTRONICS TECHNOLOGY — DATE: AUGUST, 1989

COURSE NUMBER: — SEMESTER CREDITS: 3

COURSE TITLE: MICROPROCESSOR THEORY & APPLICATIONS — PROFESSOR: G. MULLETT

COURSE DESCRIPTION:

THIS COURSE CONSISTS OF AN INTRODUCTION TO THE THEORY OF OPERATION, THE ARCHITECTURE, AND THE APPLICATIONS OF MICROPROCESSORS. FIRST, THE GENERAL ASPECTS OF MICROPROCESSOR-BASED SYSTEMS ARE CONSIDERED AND RELATED TO THE POSSIBLE APPLICATIONS OF THESE SYSTEMS TO REAL WORLD PROBLEMS AND USES. THE NEXT PORTION OF THE COURSE DEALS SPECIFICALLY WITH A PARTICULAR MICROPROCESSOR AND ITS RELATED PERIPHERAL PARTS. THE INTERNAL STRUCTURE OF THE MICROPROCESSOR IS STUDIED, AS WELL AS, ITS INSTRUCTION SET, AND PERIPHERAL INTERFACING COMPONENTS. NEXT, SOFTWARE CONCEPTS ARE COVERED AND THEN MICROPROCESSOR INTERFACING AND SYSTEM DESIGN ARE CONSIDERED. ONCE THE BASIC CONCEPTS HAVE BEEN COVERED, ATTENTION SHIFTS TO AN OVERVIEW OF THE VARIOUS MICROPROCESSORS CURRENTLY AVAILABLE. THESE DIFFERENT MICROPROCESSORS ARE COMPARED AND CONTRASTED IN TERMS OF THEIR POTENTIAL APPLICATIONS AND PROCESSING POWER. THE LAST PORTION OF THE COURSE WILL DEAL WITH SPECIFIC MICROPROCESSOR APPLICATIONS AND A LOOK AT THE PAST AND FUTURE EVOLUTION OF THE MICROPROCESSOR.

CATALOG DESCRIPTION:

THE MICROPROCESSOR IN DIGITAL CONTROL SYSTEMS, THE SUBSTITUTION OF SOFTWARE FOR HARDWARE IN LOGIC DESIGN AND THE INTERFACING OF THE MICROPROCESSOR WITH EXTERNAL DEVICES. ARCHITECTURAL FEATURES OF CURRENT MICROPROCESSORS LIKE MOTOROLA'S 68000 FAMILY AND OTHER 8/16/32 BIT PROCESSORS WILL BE EXAMINED AND A STUDY OF THE DEVICES' APPLICATIONS WILL BE UNDERTAKEN.

PREREQUISITES:

A COURSE IN DIGITAL LOGIC THEORY

COURSE PURPOSE:

TO ACQUAINT THE STUDENT WITH THE THEORY OF OPERATION OF THE MICROPROCESSOR, ITS APPLICATIONS, AND HOW IT INTERFACES TO THE REAL WORLD OF ELECTRONICS, THIS COURSE IS AN ATTEMPT TO BRIDGE THE GAP INTO THE WORLD OF COMPUTERS ON A CHIP TECHNOLOGY. THE LABORATORY WORK ALLOWS THE STUDENT TO ACTUALLY PROGRAM A MICROPROCESSOR AND MAKE IT PERFORM UNDER THE STUDENT'S CONTROL.

COURSE OBJECTIVES:

1. TO BECOME FAMILIAR WITH THE POSSIBLE APPLICATIONS OF MICROPROCESSORS.
2. TO COMPARE THE MICROPROCESSOR TO THE MINI- AND MAXI-COMPUTER.
3. TO BECOME FAMILIAR WITH THE INTERNAL STRUCTURE OF A MICROPROCESSOR.
4. TO BECOME FAMILIAR WITH A PARTICULAR MICROPROCESSOR AND ITS INSTRUCTION SET.
5. TO LEARN HOW THE MICROPROCESSOR INTERFACES TO THE REAL WORLD AND OTHER LOGIC CIRCUITRY.
6. TO COMPARE THE CURRENTLY AVAILABLE MICROPROCESSORS IN TERMS OF PROCESSING POWER AND POTENTIAL APPLICATIONS.
7. TO BECOME AWARE OF EVOLUTIONARY TRENDS WHICH ARE EXPECTED FOR FUTURE MICROPROCESSORS.

COURSE OUTLINE:

1. INTRODUCTION TO MICROPROCESSOR-BASED DESIGN
   A. HISTORY OF THE MICROPROCESSOR
   B. APPLICATIONS OF THE MICROPROCESSOR

2. GENERAL ASPECTS OF MICROPROCESSOR-BASED SYSTEMS
   A. CLASSIFICATION OF COMPUTERS
   B. GENERAL FEATURES OF MICROPROCESSORS
   C. INFORMATION FLOW
   D. ADDRESSING MODES
   E. INTERRUPTS AND SUBROUTINES

3. THE MOTOROLA 68000 FAMILY OF MICROPROCESSORS AND PERIPHERAL PARTS
   A. PROGRAMMING MODEL
   B. DATA PATHS
   C. OPERATION CODES
   D. M68000 SPECIFICATIONS
   E. PERIPHERAL INTERFACE CHIPS

4. SOFTWARE CONCEPTS FOR MICROPROCESSORS
   A. PROGRAM TRANSLATION
   B. TEXT EDITORS
   C. SIMULATORS
   D. DEBUG FEATURES
   E. IN-CIRCUIT EMULATORS
   F. LOGIC STATE ANALYZERS
   G. PROM PROGRAMMERS

5. MICROPROCESSOR INTERFACING AND SYSTEM DESIGN
   A. INTRODUCTION
   B. INTERFACING EXAMPLES
   C. OUTPUT-TTL SPEEDS
   D. SERIAL TO PARALLEL CONVERSION
   E. ADDRESS MAPS
   F. MEMORY AND I/O SELECTION
   G. SYSTEM DESIGN EXAMPLES

6. INTRODUCTION TO 8 BIT MICROPROCESSORS
   A. CHARACTERISTICS
   B. 8 BIT ARCHITECTURES AND PROGRAMMING MODEL
   C. 8 BIT INSTRUCTION SETS

7. INTRODUCTION TO 16 BIT MICROPROCESSORS
   A. CHARACTERISTICS
   B. 16 BIT ARCHITECTURES AND PROGRAMMING MODEL
   C. 16 BIT INSTRUCTION SETS
   D. COPROCESSORS AND MEMORY MANAGEMENT

8. INTRODUCTION TO 32 BIT MICROPROCESSORS
   A. CHARACTERISTICS
   B. 32 BIT ARCHITECTURE AND PROGRAMMING MODEL
   C. 32 BIT INSTRUCTION SETS
   D. COPROCESSORS & MEMORY MANAGEMENT

9. THE NEXT GENERATIONS OF MICROPROCESSORS
   A. CONVENTIONAL ARCHITECTURES
   B. PIPE-LINE & PARALLEL PROCESSORS

TEXT AND SUPPLEMENTARY MATERIALS:

"MICROPROCESSOR/HARDWARE INTERFACING AND APPLICATIONS"
BY BREY MERRILL PUBLISHERS

"THE 68000 MICROPROCESSOR" BY MILLER MERRILL

"68000 MICROCOMPUTER SYSTEMS" BY WILCOX PRENTICE-HALL

CNC MACHINE REPAIR TECHNOLOGY

(CURRICULUM DEVELOPMENT)

COURSE: INTRODUCTION TO COMPUTER NUMERICAL CONTROL (CNC)

DESCRIPTION:

This course is an introduction to the fundamental concepts of Computer Numerical Control (CNC). The importance of CNC to manufacturing and productivity is discussed in conjunction with different types of CNC systems.

The CNC repair technician must have an understanding of how a work piece is processed for CNC applications in a manufacturing environment. The student will understand the cartesian coordinate system in conjunction with CNC coordinate systems and machine axes. With this knowledge, the student will be able to convert basic part geometry into tool motion statements in programming for CNC. Coverage includes writing simple programs to perform three-axis milling operations, as well as turning and facing routines for a lathe.

In the CNC laboratory, the student will first verify the CNC program by performing a computer simulation. The program is then loaded in the appropriate machine and the part is manufactured.

TEXT:

W. S. Seames. Computer Numerical Control: Concepts and Programming. Delmar Publishers, Inc., 1986.

COURSE OUTLINE

WEEK	TOPIC	CHAPTER
1	Introduction. History of CNC. Objectives of CNC. Industrial applications.	1
2	CNC systems. Types of control systems. Cartesian coordinate system.	2
3	Tooling for CNC. Drills, reamers, millers, etc.	3
4	Tool changing and tool registers. Automatic tool changers. Tool storage.	4
5	Programming coordinates. Hole and milling operations. Absolute and incremental positioning.	5
6	Two-axis programming. Conversational programming language. Word address format.	6
7	Three-axis programming. (Mid-term exam)	7
8	Math for CNC programming. Using Trig for cutter offsets.	8
9	Linear and circular interpolation.	9
10	Cutter diameter compensation. Definitions and codes.	10
11	The CNC lathe. Axis movement. Lathe systems.	13
12	Programming CNC turning machines. Diameter versus radius programming. Turning and facing.	14
13	Do loops and Subroutines.	11
14	Advanced CNC features. Mirror imaging. Polar rotation.	12
15	Use of computers in CNC programming. CAM systems. The future of CNC.	15,16
16	(Final Exam)	

CNC MACHINE REPAIR TECHNOLOGY

(CURRICULUM DEVELOPMENT)

COURSE: FA 111- MACHINING FUNDAMENTALS

DESCRIPTION:

AN INTRODUCTORY COURSE IN MACHINING IN WHICH THE STUDENT WILL GET HANDS-ON EXPERIENCE IN RUNNING STANDARD MACHINE SHOP TOOLS SUCH AS LATHES, MILLING MACHINES, AND GRINDERS. ALSO COVERED IN CLASS AND LAB WILL BE THE USE OF HAND TOOLS, USE OF MEASURING TOOLS AND EQUIPMENT, SHOP MATH, CUTTER GEOMETRY, SPEEDS AND FEEDS, MATERIAL TREATMENT, SCREW THREAD SYSTEMS, TOLERANCES AND FITS, AND LUBRICANTS AND COOLANTS. SIMPLE TOOLS AND PROJECTS WILL BE MADE DURING THE COURSE BY STUDENTS TO EXERCISE LEARNED SKILLS.

CNC MACHINE REPAIR TECHNOLOGY

(CURRICULUM DEVELOPMENT)

COURSE: COMPUTER AIDED MANUFACTURING (CAM) I

DESCRIPTION:

In a laboratory setting, CAM I explores metal machining by utilizing a graphical software package to generate part programs for a CNC lathe. The emphasis of the course is learning to use the CAM software to select tools, enter part geometry, and convert screen graphics into a CNC program. The student then learns how to communicate the program to the machine and manufacture the part.

In addition, the student will learn the integration of Computer Aided Design (CAD) with CAM to enhance his/her understanding of proceeding from the design process through the manufacturing process.

The CNC repair technician must have an understanding of how the advanced CAM software packages are utilized by CNC machine operators to communicate with state-of-the-art equipment. Special attention is spent on the RS-232 communication system for computer-to-machine interfacing.

TEXT:

There is no formal textbook for this course. Course documentation will be handled by instructor lectures and handouts.

.N:2

COURSE OUTLINE

NOTE: CAPITALIZED WORDS ARE COMMANDS FROM SmartCAM™ CAM SOFTWARE.

WEEK	TOPIC
1	Review of CNC basics. Introduction to advanced Manufacturing (CAM). Programming techniques. Print interpretation.
2	CAM concepts. Definitions and Applications. Hardware and software basics. Job planning and tool selection.
3	Using the SHAPE module. Basic concepts. Geometry fundamentals. Screen layout. Entering data.
4	Setting FEATURES. Turning shoulders and tapers. Elements: START_PROF, LINE. ROUGHING out the part.
5	Adding LEAD_IN/OUT. Verifing tool path with VIEW: SHOW_PATH.
6	Editing commands: /LAST & ERASE, INSERT & MODIFY, BLEND & CHAMFER.
7	Turning radii and partial arcs. Element: ARC (Mid-term Exam)
8	Tool changing. SELECT_TOOL menu.
9	Threading and Grooving.
10	Advanced editing commands. MOVE, ROTATE, and IMAGE COPYING.
11	More editing commands. GROUP_SCALE, DELETE, and PURGE.
12	CAD/CAM integration. Organizing elements with TOOL_PATH commands.
13	CAM projects.
14	CAM projects (continued). Introduction to 3D machining.
15	Introduction to machine files and post processor design.
16	(Final Exam)

CNC MACHINE REPAIR TECHNOLOGY

(CURRICULUM DEVELOPMENT)

COURSE: NEW - MECHANISMS/KINEMATICS

DESCRIPTION:

THE THEORY OF LINKAGES, CAMS, GEARS, BELTS AND PULLEY DRIVES ARE STUDIED. CALCULATIONS OF VELOCITIES, ACCELERATIONS AND THE DISPLACEMENTS OF THE VARIOUS COMPONENTS ARE DETERMINED RELATIVE TO THE DESIGN CONCEPT BEING STUDIED.

TEXT:

MECHANISMS/DRIVES BY RICHARD TINNELL

Course Outline:

Experiment No.	Topic
1	Mechanical Components
2 & 3	Gears
4 & 5	Displacements,Velocities
6	Torque
7 & 8	Simple,Compound Trains
9,10,11	Other Gear Drives
12 & 13	Other Gear Drives
14	Rack & Pinion
15	Worm & Wheel Drives
17	Combined Mechanisms
22 & 23	Belts, Pulleys
25 & 26	Chain Drives, Tooth Belts
27 & 28	Disk Drives, Cams
29	Universal Joints

CNC MACHINE REPAIR TECHNOLOGY

(CURRICULUM DEVELOPMENT)

COURSE: FB - 420 FLUID POWER

DESCRIPTION:

THIS COURSE IS CONCERNED WITH THE USE OF FLUIDS IN THE GENERATION, TRANSMISSION AND CONTROL OF POWER. THE PROPERTIES OF FLUIDS ARE STUDIED IN TERMS OF THEIR EFFECTS ON HYDRAULIC AND PNEUMATIC SYSTEMS. THE BASIC LAWS GOVERNING THE MECHANICS OF FLUIDS ARE DEVELOPED AND RELATED IN PROBLEM FORM TO THE DESIGN AND OPERATION OF A FLUID SYSTEM. EMPHASIS IS PLACED ON THE STUDY OF THE SYSTEM COMPONENTS SUCH AS PUMPS, MOTORS, CONTROL VALVES AND CYLINDERS.

Semester Outline

Week	Chapter	Topic
1	1	Introduction
2	2	Basics of Hydraulics
3	3	Energy in Hydraulics Systems
4	3	Energy in Hydraulics Systems
5	4	How Fluid Flows
6	5	Friction Losses in Systems
7	6	Hydraulic Fluids
8	7	Pumps
9	8	Cylinders
10	9	Motors
11	10	Valves
12	11	Seals & Packings
13	12	System Components
14	13	Circuits & Sizing Components
15	14	Troubleshooting

CNC TROUBLESHOOTING LAB

COURSE: NEW

A COMPREHENSIVE LABORATORY COURSE ENCOMPASSING ALL FACETS OF CNC MACHINE REPAIR. THE STUDENT WILL UNDERSTAND BLOCK DIAGRAMMING AS RELATED TO PROBABLE CAUSES OF SYMPTOMS, THEIR EFFECTS, AND POTENTIAL CAUSES OF SYMPTOMS, THEIR EFFECTS, AND POTENTIAL SOLUTIONS. COVERAGE WILL INCLUDE POWER FAILURES, POWER INTERRUPTIONS, POSITIONING ERRORS, LACK OF SPINDLE CONTROL, AND INTERMITTENT PROBLEMS. PRACTICAL APPLICATIONS ON APPROPRIATE MACHINERY TO RESTORE THE EQUIPMENT TO OPERATIONAL SERVICE.

1. INTRODUCTION. REVIEW OF FUNDAMENTALS.
2. RELATING PREVIOUS COURSE MATERIALS IN FORMULATING BLOCK DIAGRAMS.
3. MACHINE RESIDENT SELF-DIAGNOSTICS.
4. ANALYZING SYMPTOMS TO THE BLOCK DIAGRAM.
5. POWER FAILURES AND INTERRUPTIONS.
6. HYDRAULIC PROBLEMS.
7. POSITIONING ERRORS.
8. SPEED CONTROLS.

ELECTRICAL

CNC TROUBLESHOOTING LAB

1. POWER-UP/POWER-DOWN

2. MICROPROCESSOR

    A. SOFTWARE
    B. HARDWARE

        1. PROCESSOR
        2. MEMORY
        3. I/O

3. MOTOR CONTROLS

    A. JOGGING
    B. FORWARD/REVERSE
    C. SPEED

4. SENSORS/TRANDUCERS

    A. A/D, D/A
    B. LIMIT SWITCHES

        1. LED'S
        2. PROXIMITY
        3. MICRO

    C. SPEED SENSORS

CNC REPAIR

VOCATIONAL COURSE

GRADE 9

REQUIRED COURSES	PERIODS PER WEEK	CREDIT
ENGLISH 9	5	5
MATHEMATICS	5	5
SOCIAL STUDIES	5	5
PHYSICAL EDUCATION	5	5
VOCATIONAL EXPLORE	5	5
VOCATIONAL EXPLORE THEORY	5	5
ELECTIVE	5	5
TOTAL	35	35

GRADE 10

REQUIRED COURSES	PERIODS PER WEEK	CREDIT
ENGLISH 10	5	5
MATHEMATICS	5	5
VOCATIONAL THEORY/ PHYSICAL EDUCATION	5	5
VOCATIONAL I	20	20
TOTAL	35	35

GRADE 11

REQUIRED COURSES	PERIODS PER WEEK	CREDIT
ENGLISH 11	5	5
MATHEMATICS	5	5
VOCATIONAL THEORY II	5	5
VOCATIONAL THEORY II	20	20
TOTAL	35	35

GRADE 12

REQUIRED COURSES	PERIODS PER WEEK	CREDIT
ENGLISH 12	5	5
U.S. HISTORY	5	5
VOCATIONAL THEORY 111	5	5
VOCATIONAL 111	20	20
TOTAL	35	35

CNC REPAIR TECHNOLOGY

GRADE 10 THEORY

TOPIC OUTLINE

THE GRADE 10 CNC REPAIR CURRICULUM WILL CONSIST OF THE FOLLOWING AREAS; BASIC ELECTRICITY, BASIC PROGRAMMING AND MACHINING FUNDAMENTALS.

TOPIC WILL INCLUDE:

A. BASIC ELECTRICITY

1. UNDERSTAND AND APPLY OHM'S LAW.
2. ANALYZE COMPLEX SERIES AND PARALLEL RESISTIVE CIRCUITS.
3. UNDERSTAND FUNDAMENTAL TROUBLE SHOOTING TECHNIQUES.
4. UNDERSTAND AND USE THEVENIN'S THEOREM.
5. UNDERSTAND AND APPLY THE SUPERPOSITION THEOREM.
6. USE KIRCHOFF'S LAWS.
7. UNDERSTAND AND USE NORTON'S THEOREM.
8. UNDERSTAND AND USE A CALCULATOR.
9. BE ABLE TO MEASURE CURRENT, VOLTAGE AND RESISTANCE.
10. UNDERSTAND AND APPLY OHM'S LAW TO AN AC CIRCUIT.
11. ANALYZE COMPLEX SERIES AND PARALLEL AC RESISTIVE CIRCUITS.
12. UNDERSTAND FUNDAMENTAL TROUBLE SHOOTING TECHNIQUES.
13. UNDERSTAND AND USE THEVENIN'S THEOREM IN AN AC CIRCUIT.
14. UNDERSTAND AND APPLY THE SUPERPOSITION THEOREM.
15. USE KIRCHOFF'S LAWS IN AN AC CIRCUIT.
16. UNDERSTAND AND USE NORTON'S THEOREM.
17. UNDERSTAND AND APPLY THE MAXIMUM POWER THEOREM.
18. BE ABLE TO MEASURE CURRENT, VOLTAGE AND RESISTANCE.

B. BASIC PROGRAMMING

1. INTRODUCTION TO COMPUTERS.

2. COMPUTER PERIPHERALS.

3. INTRODUCTION TO PROGRAMMING IN BASIC.

4. BRANCHING.

5. PROGRAM LOOPS.

6. FUNCTIONS FOR ELECTRONICS.

C. MACHINING FUNDAMENTALS

1. INTRODUCTION ... SHOP MATH AND GEOMETRY.
INTRO. TO SHOP ., LATHE OPERATION- SPINDLE AND GEAR BOX, SPINDLE TOOLING, SADDLE OPERATION.

2. HAND TOOL SELECTION AND USE.
LATHE OPERATION-CENTERING, FACING, TURNING, TAIL-STOCK TOOLING, NECKING, KNURLING.

3. BLUEPRINT READING.
OPERATE DRILL PRESS. SHARPEN LATHE BITS, SHARPEN DRILLS.

4. BLUEPRINT READING.
LATHE OPERATIONS-DRILLING, TAPPING, REAMING, STOPS, TAPERS.

5. BLUEPRINT READING. TOLERANCES AND FITS.
LATHE OPERATIONS-BORING, COUNTERBORING, STEADY-RESTS, FOLLOWERS.

6. SCREW THREAD SYSTEMS. MEASURING SYSTEMS, USE OF MEASURING TOOLS.
LATHE OPERATION-THREAD CUTTING.

7. MANUFACTURING MATERIALS. CUTTER GEOMETRY, SPEEDS AND FEEDS.
BRIDGEPORT OPERATION-FLAT, STEP, SLOT AND EDGE MILLING.

8. LUBRICANTS AND COOLANTS.
BRIDGEPORT OPERATION-ROTARY TABLES, DIVIDING HEADS, ANGULAR WORK.

9. HORIZONTAL MILLING MACHINES.
TURRET LATHES, CHUCKERS, SCREW MACHINES. WORK ON PROJECTS.

10. INSPECTION TECHNIQUES AND PROCEDURES.
SURFACE GRINDING OPERATION-FLAT, PARALLEL, PERPENDICULAR, FORM.

11. HEAT TREATMENT. SURFACE COATINGS AND FINISHES.
O.D./I.D. GRINDING- AN OVERVIEW. WORK ON PROJECTS.

12. N/C HISTORY AND ECONOMICS.
WORK ON PROJECTS.

13. PROGRAMMING A N/C MACHINE-BRIDGEPORT SLO-SYN EQUIPPED.
WORK ON PROJECTS.

14. PROGRAMMING A SLO-SYN BRIDGEPORT.
OPERATING A SLO-SYN BRIDGEPORT. WORK ON PROJECTS.

15. PROGRAM A N/C LATHE.
OPERATE A N/C LATHE.

CNC REPAIR TECHNOLOGY

GRADE 11 THEORY

THE GRADE 11 CNC REPAIR CURRICULUM WILL CONSIST OF THE FOLLOWING: SOLID STATE ELECTRONICS, FUNDAMENTALS OF MOTOR CONTROLS, CNC PROGRAMMING AND AN INTRODUCTION TO COMPUTER AIDED MANUFACTURING.

TOPIC

A. INTRODUCTION TO CNC PROGRAMMING

1. INTRODUCTION. HISTORY OF CNC. OBJECTIVES OF CNC. INDUSTRIAL APPLICATIONS.

2. CNC SYSTEMS. TYPES OF CONTROL SYSTEMS. CARTESIAN COORDINATE SYSTEM.

3. TOOLING FOR CNC. DRILLS, REAMERS, MILLERS, ETC.

4. TOOL CHANGING AND TOOL REGISTERS. AUTOMATIC TOOL CHANGERS. TOOL STORAGE.

5. PROGRAMMING COORDINATES. HOLE AND MILLING OPERATIONS. ABSOLUTE AND INCREMENTAL POSITIONING.

6. TWO-AXIS PROGRAMMING. CONVERSATIONAL PROGRAMMING LANGUAGE. WORD ADDRESS FORMAT.

7. THREE-AXIS PROGRAMMING.

8. MATH FOR CNC PROGRAMMING. USING TRIG FOR CUTTER OFFSETS.

9. LINEAR AND CIRCULAR INTERPOLATION.

10. CUTTER DIAMETER COMPENSATION. DEFINITIONS AND CODES.

11. THE CNC LATHE. AXIS MOVEMENT. LATHE SYSTEMS.

12. PROGRAMMING CNC TURNING MACHINES. DIAMETER VERSUS RADIUS PROGRAMMING. TURNING AND FACING.

13. DO LOOPS AND SUBROUTINES.

14. ADVANCED CNC FEATURES. MIRROR IMAGING. POLAR ROTATION.

15. USE OF COMPUTERS IN CNC PROGRAMMING. CAM SYSTEMS. THE FUTURE OF CNC.

B. FUNDAMENTALS OF MOTOR CONTROLS

1. INTRODUCTION - MOTOR CONTROLS SAFETY.
2. INDUSTRIAL ELECTRICAL SYMBOLS.
3. LINE DIAGRAMS. LOGIC.
4. LOGIC APPLICATION TO LINE DIAGRAMS.
5. AC MANUAL CONTACTORS.
6. MOTOR STARTERS.
7. MAGNETISM AND MAGNETIC SOLENOIDS.
8. AC/DC CONTACTORS.
9. MAGNETIC MOTOR STARTERS.
10. TIME DELAYS.
11. TIME DELAYS AND COMPLEX LINE DIAGRAMS.
12. CONTROL DEVICES.
13. REVERSING CIRCUITS.
14. POWER DISTRIBUTION SYSTEMS.
15. SWITCHBOARDS AND PANELS.
16. SOLID STATE ELECTRONIC CONTROL.
17. SOLID STATE CONTROL DEVICES.
18. ELECTROMECHANICAL RELAYS.
19. SOLID STATE RELAYS.
20. PHOTOELECTRIC CONTROL.
21. PROXIMITY CONTROL.
22. PROXIMITY & PHOTOELECTRIC APPLICATIONS.
23. PROGRAMMABLE CONTROLS.
24. USES FOR PROGRAMMABLE CONTROLS.
25. APPLICATIONS AND CONTROL STRATEGIES.
26. PROGRAMMING A PLC.

C. SOLID STATE ELECTRONICS

1. INTRODUCTION - SEMICONDUCTOR DEVICES & CONVENTIONAL CURRENT AND ELECTRON FLOW.
2. VOLTAGE AND CURRENT SOURCES.
3. THEVENIN'S THEOREM.
4. NORTON'S THEOREM.
5. DIODE THEORY - CONDUCTION IN CRYSTALS/DOPING.
6. DIODE BIASING.
7. LINEAR DEVICES -GRAPH, LOAD LINE.
8. DIODE APPROXIMATIONS - DC RESISTANCE.
9. DIODE CIRCUITS - SINEWAVE, TRANSFORMER.
10. RECTIFICATION - 1/2, FULL, BRIDGE.
11. CAPACITANCE - INPUT FILTERS.
12. MULTIPLIERS, LIMITER, CLAMPER, P-P DETECTOR AND DC RETURN.
13. ZENER DIODE (REGULATOR).
14. OPTOELECTRONIC DEVICES.
15. SCHOTTKY DIODE, VARACTOR, MISC.
16. BIPOLAR TRANSISTORS.
17. FORWARD/REVERSE BIAS.
18. CE CONNECTION, CHARACTERISTICS.
19. DC LOAD LINE, TRANSISTOR SWITCH.
20. CURRENT SOURCE.
21. OPTOELECTRONIC DEVICES, TROUBLESHOOTING, DESCRETE/ INTEGRATED CKTS.
22. TRANSISTOR BIASING, BASE BIAS.
23. EMITTER - FEEDBACK, COLLECTOR-FEEDBACK BIAS.

24. VOLTAGE DIVIDER & EMITTER BIAS.

25. MOVING GROUND AND PNP CKTS.

26. AMPLIFIERS.

CNC REPAIR TECHNOLOGY

GRADE 12 THEORY

THE GRADE 12 CNC REPAIR CURRICULUM WILL CONSIST OF THE FOLLOWING; COMPUTER AIDED MANUFACTURING, FLUID POWER, INDUSTRIAL ELECTRONICS, MICROPROCESSOR THEORY AND APPLICATIONS, AND CNC TROUBLE SHOOTING.

COURSE OUTLINE

NOTE: CAPITALIZED WORDS ARE COMMANDS FROM SMARTCAM™ CAM SOFTWARE.

TOPIC

A. COMPUTER AIDED MANUFACTURING

1. REVIEW OF CNC BASICS. INTRODUCTION TO ADVANCED MANUFACTURING (CAM). PROGRAMMING TECHNIQUES. PRINT INTERPRETATION.

2. CAM CONCEPTS. DEFINITIONS AND APPLICATIONS. HARDWARE AND SOFTWARE BASICS. JOB PLANNING AND TOOL SELECTION.

3. USING THE SHAPE MODULE. BASIC CONCEPTS. GEOMETRY FUNDAMENTALS. SCREEN LAYOUT. ENTERING DATA.

4. SETTING FEATURES. TURNING SHOULDERS AND TAPERS. ELEMENTS: START _PROF, LINE. ROUGHING OUT THE PART.

5. ADDING LEAD _ IN/OUT. VERIFYING TOOL PATH WITH VIEW: SHOW _PATH.

6. EDITING COMMANDS: /LAST & ERASE, INSERT & MODIFY, BLEND & CHAMFER.

7. TURNING RADII AND PARTIAL ARCS. ELEMENT: ARC

8. TOOL CHANGING. SELECT _TOOL MENU.

9. THREADING AND GROOVING.

10. ADVANCED EDITING COMMANDS. MOVE, ROTATE, AND IMAGE COPYING.

11. MORE EDITING COMMANDS. GROUP_SCALE, DELETE, AND PURGE.

12. CAD/CAM INTEGRATION. ORGANIZING ELEMENTS WITH TOOL_PATH COMMANDS.

13. CAM PROJECTS.

14. CAM PROJECTS (CONTINUED). INTRODUCTION TO 3D MACHINING.

15. INTRODUCTION TO MACHINE FILES AND POST PROCESSOR DESIGN.

B. FLUID POWER

1. BASICS OF HYDRAULICS.

2. ENERGY IN HYDRAULICS SYSTEMS.

3. ENERGY IN HYDRAULICS SYSTEMS.

4. HOW FLUID FLOWS.

5. FRICTION LOSSES IN SYSTEMS.

6. HYDRAULIC FLUIDS.

7. PUMPS.

8. CYLINDERS.

9. MOTORS.

10. VALVES.

11. SEALS & PACKINGS.

12. SYSTEM COMPONENTS.

13. CIRCUITS & SIZING COMPONENTS.

14. TROUBLESHOOTING.

C. INDUSTRIAL ELECTRONICS

1. INTRODUCTION TO INDUSTRIAL ELECTRONICS.

2. THE TRANSISTOR SWITCH.

3. SOLID STATE LOGIC.

4. TRANSISTOR SWITCH APPLICATIONS.

5. TIMERS.
6. SCR THEORY.
7. SCR APPLICATION.
8. UJT THEORY.
9. UJT APPLICATION.
10. TRIACS AND OTHER THYRISTORS THEORY.
11. TRIAC APPLICATION.
12. OPERATIONAL AMPLIFIERS.
13. POWER SUPPLIES & POWER AMPLIFIERS.
14. INTEGRATED CIRCUIT TIMERS.
15. D/A & AD CONVERTERS.

GRADE 12 - TROUBLESHOOTING LAB

1. INTRODUCTION - REVIEW OF FUNDAMENTALS.
2. RELATING PREVIOUS COURSE MATERIALS IN FORMULATING BLOCK DIAGRAMS.
3. MACHINE RESIDENT SELF-DIAGNOSTICS.
4. POWER UP/DOWN.
5. ANALYZING SYMPTOMS TO THE BLOCK DIAGRAM.
6. POWER FAILURES AND INTERRUPTIONS.
7. HYDRAULIC PROBLEMS.
8. POSITIONING ERRORS.
9. SPEED CONTROLS.
10. MICROPROCESSOR HARDWARE/SOFTWARE.
11. MICROPROCESSOR INPUT/OUTPUT.
12. MOTOR CONTROLS - FORWARD/REVERSE.
13. MOTOR CONTROLS - SPEED.
14. SENSORS/TRANSDUCERS.
    - A. ANALOG/DIGITAL
    - B. DIGITAL/ANALOG
    - C. LIMIT SWITCHES
    - D. LED'S
    - E. PROXIMITY SWITCHES
    - F. MICRO SWITCHES
    - G. SPEED SENSORS